EVALUATING THE EFFECTIVENESS OF STATE-LEVEL POLICIES AND STRATEGIES ON CHILDHOOD BLOOD LEAD TESTING RATES

by

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(Under the Direction of Cham Dallas)

ABSTRACT

Lead exposure can harm nearly every organ in the human body, and millions of U.S. children are exposed to significant lead hazards. Identifying chidlren with elevated blood lead levels via blood lead testing is essential for connecting them to appropriate follow up services. No states achieved full compliance with federal or state blood lead testing requirements. This analysis provides critical evidence-based information to understand better which state-level policies/strategies (or combination thereof) are more effective at increasing childhood blood lead testing rates: 1) metrics, 2) incentives, 3) other managed care organization (MCO) guidance, 4) provider guidelines, 5) mandatory reporting of results to state health departments, 6) data sharing between Medicaid and other state agencies, and 7) proof of testing for school enrollment. This analysis included 33 states with complete data on number of children who received blood lead testing in 2017-2018 as reported to the Centers for Disease Control and Prevention. Linear regression modeling was conducted using SAS 9.4. Fully adjusted models included percentages of the population living in pre-1980 housing, < six years of age with Medicaid coverage, and foreign-born. Strongest unadjusted and adjusted regression coefficients were for requiring proof of testing for school enrollment (0.12, $p = 0.03$) and requiring reporting of metrics (0.06, p=0.01), respectively. For combinations, strongest unadjusted and adjusted regression coefficients were for “proof of testing for school enrollment and metrics” (0.16, $p<0.01$) and a tie between “metrics and MCO guidance” (0.08, $p=0.04$) and “metrics and provider guidelines” (0.08, $p<0.01$), respectively. To increase testing rates, states should focus on requiring proof of testing for school enrollment, requiring reporting of lead metrics, and providing MCO guidance. To facilitate adopting additional policies, states should work with local American Academy of Pediatrics chapters, disseminate data on testing performance to providers, and raise awareness about the importance of identifying lead-exposed children to mitigate harmful effects of lead. Children who receive interventions to reduce adverse impacts of lead exposure are more likely to exhibit academic readiness, spend less time in special education, graduate high school, and have reduced contact with the criminal justice system which results in overall benefits to society.

INDEX WORDS: Childhood lead poisoning, Blood lead testing, Blood lead levels, Increasing blood lead testing rates

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CHAPTER 1

INTRODUCTION

Background and Problem Statement

Lead exposure can affect nearly every organ in the human body, with neurological, renal, cardiovascular, hematological, immunological, reproductive, and developmental effects being the most studied endpoints (Agency for Toxic Substances and Disease Registry [ATSDR], 2020). Epidemiologic studies have found that lead exposure contributes to an increased risk of cancer, including all cancers, glioma, and cancers of the larynx and respiratory and intestinal tracts (ATSDR, 2020). Lead is more toxic to children than adults because their internal and external tissues are softer which allows more lead to accumulate, and chidlren are less efficient at elimating lead from their bodies (Wani et al., 2015).

Exposure to lead can damage children’s cognitive function, slow growth and development, and result in learning, behavior, hearing, and speech problems (ATSDR, 2020). Other neurological effects in children include altered neuromotor and neurosensory function, peripheral neuropathy, and encephalopathy. It is now widely recognized that there is no identified safe level of lead in children’s blood (Centers for Disease Control and Prevention [CDC], 2021a). A pooled analysis found evidence of intellectual deficits at blood lead levels (BLLs) as low as 2.4 ug/dL (Lanphear et al., 2005). Future related health effects from childhood lead poisoning include neurologic disorders, adult hypertension, heart disease, stroke, kidney malfunction, elevated blood pressure, and osteoporosis (ATSDR, 2020; Gould, 2009).

Several laws were enacted beginning in the 1970s to control exposure to lead by reducing emissions and banning lead in certain products (Dignam et al., 2019). Key laws include the

- Lead-Based Paint Poisoning Act of 1971 (effective in 1978), which banned lead-based paint in residences constructed or rehabilitated by the federal government or with federal assistance,
- 1986 amendment to the Safe Drinking Water Act (effective in June 1988), which required lead-free solder, flux, fittings, and pipes,
- 1995 ban on food cans with lead solder, including imported cans,
- 1996 ban on leaded gasoline for most motor vehicles, and
- 2008 Consumer Product Safety Improvement Act which mandated the reduction of the lead limit in toys and other children's products to 0.009% by weight (Dignam et al., 2019; CDC, 2021b).

Despite these actions, children may still be exposed to lead. Lead-based paint in homes built before 1978 can weather and deteriorate (peel, chip, chalk, crack, or be damaged or damp). This deterioration can create lead-contaminated chips and dust if the paint is not properly removed, repaired, or abated and cleaned up (CDC, 2020a; U.S. Environmental Protection Agency, 2020). Children may also be exposed to lead-based paint by chewing on surfaces such as windows, windowsills, doors, door frames, stairs, railings, banisters, and porches. Additionally, these areas are prone to wear-and-tear, which can also create lead-contaminated chips or dust.

Other sources of lead exposure include lead deposits in soil from past leaded gasoline, exterior lead-based paint, and industries; certain water pipes, faucets, plumbing fixtures, solder, and pipe fittings; some consumer products such as toys and jewelry; candies imported from other countries or traditional home remedies; living near airports because of lead in aviation gas; and take-home exposures from family members whose jobs and hobbies involve working with lead-based products, such as lead mining and smelting, plumbing, car repair, glass manufacturing, construction, battery manufacturing and recycling, firing ranges, plastic manufacturing, mixing or applying glaze or pigments containing lead, and home renovation and repair in structures built before 1978 (CDC, 2020a; Wani et al., 2015).

The American Healthy Homes Survey II estimates that children in more than 3.3 million households in the United States are currently exposed to significant lead-based paint hazards (U.S. Department of Housing and Urban Development, 2021). Additionally, children who are racial minorities and who live in poverty face disparities in childhood BLLs (CDC, 2021c). African American/black children and children living in low-income families are disproportionately more likely to face housing inequity. These populations are less likely to have access to quality, safe housing and may be discriminated against when looking for a safe, healthy place to live. This inequity makes these populations more susceptible to lead poisoning from living in homes that contain lead-based paint, lead pipes, faucets, and plumbing fixtures.

The costs for the more immediate adverse health effects and health-related quality of life (HRQoL) effects were conservatively estimated to be as large as $53 billion for all children born in a given year (Gould, 2009). Several studies have shown that childhood lead poisoning results in lost lifetime earnings ranging from $165–$233 billion and productivity losses of approximately $267 million due to reduced IQ points (Dixon et al., 2012; Gould, 2009; Grosse et al., 2002; Health Impact Project, 2017; Minnesota Department of Health, 2019; Nevin et al., 2008). An estimated $25-$35 billion in lost tax revenue is expected for each cohort of lead-poisoned children (Gould, 2009). According to Gould (2009), the United States spent between

$10–146 million for three years of special education for each cohort of lead-poisoned children. Additionally, childhood exposure to lead has been associated with higher arrest rates, including violent offenses, with total direct costs estimated at $1.8 billion (Gould, 2009; Wright et al., 2008).

The lead-contaminated drinking water in Flint, Michigan, during 2014-2015 brought renewed interest to the issue of childhood lead poisoning prevention (Hanna-Attisha et al., 2016; Kennedy et al., 2016; Ruckart et al., 2019). As a result of the Flint water crisis, the U.S. Congress passed the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016, which formally recognized the need to strengthen the nation's lead poisoning prevention programs (Water Infrastructure Improvements for the Nation Act of 2016). This act included funding for CDC to establish a new federal advisory committee and enhance their Childhood Lead Poisoning Prevention Program (CLPPP) activities whose funding had been severely reduced in 2012. The charge of the new Lead Exposure and Prevention Advisory Committee (LEPAC) included identifying best practices regarding lead testing (CDC, 2018).

Primary prevention, defined as the removal of lead hazards in the environment before children are exposed to lead, is crucial to ensuring that children do not experience elevated BLLs (EBLLs) (Ettinger et al., 2019). However, until primary prevention of exposure to lead is accomplished, secondary prevention – such as conducting childhood blood lead testing – is vital to eliminating continued exposures and reducing adverse health effects (Boufides et al., n.d.; CDC, 2021a). Identifying which children are exposed to lead (via results of a blood lead test) and subsequently have EBLLs is essential for connecting them to needed environmental, medical, nutritional, and behavioral services as well as early learning interventions to mitigate adverse health effects (Billings & Schnepel, 2018; Dickman, 2017; Rischitelliet al., 2006).

Although the American Academy of Pediatrics (AAP) recommended that pediatricians and public health officials be aware of jurisdiction-specific and professional guidance and requirements for childhood blood lead testing, a recent analysis found that public health agencies are not effectively communicating their testing policies to health care providers (Council on Environmental Health, 2017; Roberts et al., 2017). Furthermore, statutory requirements are not being enforced. According to a recent report, 45 states and the District of Columbia state that they follow universal testing requirements that all Medicaid-enrolled children are tested for EBLLs at 1 and 2 years of age or between 2 and 6 years of age if there is no record of a previous blood lead test (Dickman, 2017). Currently, only Arizona is approved by the Centers for Medicare and Medicaid Services (CMS) to conduct targeted testing of high-risk populations (Centers for Medicare and Medicaid Services [CMS], n.d.). Additionally, several states have their own policies for blood lead testing in non-Medicaid enrolled children. CDC recommends that state-specific data be used to determine the best testing policies for their jurisdiction; however, universal testing is recommended in the absence of such state-specific policies (CDC, 1997). Despite these declarations, the 2017 report found that no states achieved 100% compliance with the Medicaid or state requirement of blood lead testing in children at 1 and 2 years of age (Dickman, 2017).

Purpose of the Study

Due to the varied state approaches and resulting testing rates, there is a need to determine how performance-based metrics, incentives, laws, policies, and strategies affect blood lead testing rates and the optimal set of policies and strategies to ensure maximum testing rates.

Study Question

The analysis aims to inform evidence-based public health practice. The study question seeks to determine how performance-based metrics, incentives, laws, policies, and strategies affect blood lead testing rates by asking “Which childhood lead testing policy/strategy is associated with the highest childhood blood lead testing rates” and “What combination of childhood lead testing policies and strategies results in the highest childhood blood lead testing rates?” A 2018 report by the National Academy for State Health Policy (NASHP) and the Maternal Child Environmental Health Collaborative Improvement Innovation Network (MCEH COIIN) summarizes, by state, all childhood lead-related policies and strategies that promote lead testing and are described in more detail in the Literature Review section (National Academy for State Health Policy [NASHP] & Maternal Child Environmental Health Collaborative Improvement Innovation Network [MCEH COIIN], 2018).

Hypothesis and Rationale

The hypothesis is that states that employ the policy requiring proof of lead testing for school enrollment, alone or in conjunction with other policies and strategies, will be associated with higher testing rates compared to states that employ other policies/strategies The rationale for the hypothesis is that requiring proof of lead testing for school enrollment will motivate parents/caregivers to ask their child's provider to test BLLs, which will increase testing rates beyond what is initiated by the provider.

Aims

1.To understand the contributions that federal and state laws, policies, and guidelines make to increasing childhood blood lead testing rates.

2. To develop guidance for best practices for improving childhood blood lead testing rates.

Objectives

1. Research how states incorporate federal and state laws, policies, and guidelines to promote childhood blood lead testing.
2. Obtain data on the number and proportion of children <6 years of age who are tested for childhood lead poisoning from the Centers for Disease Control and Prevention (CDC) Childhood Blood Lead Surveillance (CBLS) system for 2017-2018 and data on potential confounders from publicly available datasets.
3. Analyze data to determine which specific childhood lead poisoning testing policies/strategies or combination of policies/strategies are associated with higher testing rates.
4. Analyze data to determine if states with more childhood lead poisoning testing policies/strategies have higher testing rates than states with fewer policies/strategies.
5. Make recommendations so that state and local public health agencies can take action to improve childhood blood lead testing rates.

CHAPTER 2

LITERATURE REVIEW

Despite federal and state laws aimed at mandating blood lead testing in children, providers may let their inherent biases dictate which children to test for EBLLs and, therefore, may miss identifying a child who needs appropriate follow-up services and case management to mitigate the adverse effects of lead exposure. Two articles have examined barriers to blood lead testing at the local level. A study that evaluated the rate of blood lead testing among Medicaid-enrolled children in Michigan found that although most providers who did not routinely test BLLs were aware of the testing requirements, they believed their practice was in a low-risk area (Kemper & Clark, 2005). Despite this belief, over a third of the providers' practices were in high-risk areas. Providers in this study were more likely to test BLLs if their practice had a larger proportion of children < 5 years of age who were enrolled in Medicaid and a larger number of children identified in the past five years with an EBLL. A study in Vermont attempted to survey all pediatricians in the state to identify predictors of blood lead testing since the state health department determined the entire state to be at high risk for EBLL (Keeshan et al., 2010). The Vermont study found that pediatricians were less likely to test for BLLs if they believed that adverse health effects did not occur until BLLs of at least 10 ug/dL, if they disagreed with the state's testing recommendations, or if they served a low percentage of Medicaid-enrolled patients. These two studies further demonstrate the need for determining the most successful strategies to influence providers’ testing decisions to increase childhood blood lead testing rates on a larger scale.

A recent analysis of 29 systematic reviews that encompassed 150 primary studies examined the effects of public health policies, including screening and testing, on health inequalities in high-income countries and found that although overall results were mixed, policy interventions aimed at screening/testing suggested associations with reducing health inequalities (Thomson et al., 2018). Findings were not firmer because of heterogeneity in the quality of available evidence available, the nature of the interventions, and the primary studies reviewed. A study conducted in New York showed that enacting a policy in 1992 that required reporting of all blood lead tests regardless of BLL was effective at increasing testing rates from 16% in 1993 to 30% in 1994 (Kennedy et al., 2014). While these findings suggest that public health policies (some at the state level) effectively encourage providers to increase their BLL testing rates, more studies are needed to examine further the relationship between state screening and testing policies for childhood BLLs and health promotion and prevention. This analysis helps address this gap in the literature.

Strategies to Promote Increased Childhood Blood Lead Testing

CMS recommends several actions that states can take to improve their childhood blood lead testing rates (CMS, 2016). These include understanding state-specific testing rates to identify inconsistencies and areas for improvement; ensuring clearly written, consistent and accurate messaging in all coverage materials, manuals, periodicity schedules, the state website, and educational information given to providers/Managed Care Organization (MCOs) and families; partnerships and data-sharing agreements between state agencies as well as MCOs and non-traditional partners that are involved in BLL testing; aligning a state's Children’s Health Insurance Program (CHIP) with Medicaid testing requirements; and developing Health Services Initiatives (HSIs) such as funding local health departments to conduct testing (CMS, 2016). It is essential for states to collaborate with MCOs because more than two-thirds of children enrolled in Medicaid or CHIPs receive care through an MCO (CMS, 2016). Furthermore, a 2017 report suggested that policy initiatives to improve blood lead testing among children at high risk of lead exposure should include federal and state health agencies partnering with parents of lead-poisoned children, healthcare providers, Medicaid, and CHIP to identify and remove barriers to blood lead testing and reporting. (Health Impact Project, 2017).

Policy approaches to increase childhood blood lead testing rates include metrics, incentives, performance improvement projects (PIPs), provider guidelines, and data sharing (Kartika, 2018a). Because Medicaid-eligible children account for 60% of all cases of childhood lead poisoning in the United States, several policies are focused on this at-risk population, such as requiring state Medicaid programs to adhere to Federal laws and policies on blood lead testing all Medicaid-eligible children at 1 and 2 years of age (CMS, n.d.). Additionally, several states have their own policies for blood lead testing in non-Medicaid enrolled children and use strategies such as HSIs to prevent lead poisoning among low-income children (Dickman, 2017; NASHP & MCEH COIIN, 2018). However, implementation of blood lead testing policies is inconsistent and not closely monitored (Boufides et al., n.d.; Dickman, 2017; U.S. General Accounting Office [GAO], 1999). In 2018, NASHP and the MCEH COIIN published a document that summarized, by state, all childhood lead-related policies that promote lead testing and treatment; the document includes details on lead testing metrics, lead testing incentives, other MCO guidance, provider guidelines in addition to federal Medicaid requirements, and other requirements (e.g., data sharing, reporting requirements, blood lead screening required for school enrollment) (NASHP & MCEH COIIN, 2018).

Metrics

Metrics are used to quantify improvements in healthcare quality and health system performance, and criteria for a meaningful set of national standards include identifying a reasonable set of measures, stakeholder acceptance, and a straightforward tracking system (Claxton et al., 2015; Thompson & Harris, 2001). The most common and influential set of metrics used in the United States is the Health Plan Employer Data and Information Set (HEDIS), which includes six domains of care: effectiveness, accessibility, experience, utilization, health plan descriptive information, and measures collected using electronic clinical data systems (National Committee for Quality Assurance [NCQA], 2020a; Thompson & Harris, 2001). Although initially developed by a small group of employers and health maintenance organizations, HEDIS is currently managed and maintained by the National Committee for Quality Assurance (NCQA) with contributions from a diverse set of stakeholders, including private and public purchasers, consumers, MCOs, providers, researchers, and policymakers (Thompson & Harris, 2001). Even though HEDIS measures are specific to Medicaid, CHIPs and other agencies are encouraged to adopt them (CMS, 2016). The HEDIS measure description for childhood lead poisoning is “the percentage of children 2 years of age who had one or more capillary or venous lead blood test for lead poisoning by their second birthday” (National Committee for Quality Assurance [NCQA], 2020b).

Incentives

Incentives use financial and non-financial (i.e., recognition) rewards to motivate providers and encourage them to strive for improvements in quality, efficiency, and costs (Abduljawad & Al-Assaf, 2011). With financial incentives, providers and MCOs (both privately and publicly paid) can receive bonus payments for meeting testing objectives (for example, if their HEDIS score is in the top 50th percentile of the NCQA measure or if they improve two percentage points over their previous HEDIS score) or payments can be withheld if goals are not met or performance is unsatisfactory (Honsberger et al., 2018; Kartika, 2018a). Pay-for-performance (P4P), a type of value-based purchasing (VBP) incentive, provides monetary bonuses or reductions in payments based on performance in quality, efficiency, and cost metrics (Damberg et al., 2014).

Other MCO Guidance

The 2014 report “Measuring Success in Health Care Value-Based Purchasing Programs” found that the strength of the evidence for P4P programs targeted to physicians or physician groups was low for improving clinical process measures aimed at quality and value based on 39 studies, some of which were cross-sectional or focused on short-term, small-scale interventions which limited conclusions, and insufficient for cost savings based on four studies (Damberg et al. 2014). The 2014 report recommended that the Department of Health and Human Services develop a national VBP strategy. Using three existing models as a foundation, Damberg et al. (2014) created a conceptual framework to guide the implementation and assessment of VBP programs (Figure 1). Their framework investigates the inter-relationships between the contextual elements of program design features, characteristics of providers and practice settings, and external factors. Program design features include goals, measures, financial incentives, other program components, and patient population of interest. Characteristics of providers and practice settings include financial and other resources, populations served, structure, and organizational culture. External factors include other payment policies and quality initiatives, local fiscal environment, regulatory changes, and patient demands.

Using HEDIS or other performance information, PIPs give states the flexibility to determine what areas of concern they wish to focus on to achieve their Medicaid MCO goals by designing and conducting a quality improvement project to strengthen delivery processes and outcomes (CMS, 2012; CMS, 2016; Honsberger et al., 2018). PIPs also encourage MCO collaboration to reach a shared goal and can include incentives (CMS, 2016; Honsberger et al., 2018).

Additional Provider Guidelines

Given that CDC recommends that state-specific data be used to determine the best testing policies for their jurisdiction, several states have developed provider guidelines for blood lead testing in children in addition to federal Medicaid requirements (CDC, 1997). These state-specific provider guidelines can be either mandatory or recommended. A report by the U.S. General Accounting Office (now Government Accountability Office) found that childhood blood lead testing rates were highest in states with their own testing statutes and strategies (GAO, 1999). An analysis by Roberts et al. (2017) used modeling to predict the numbers of children with EBLLs during 1999-2010 by reporting status (reported, missed by undercounting, missed by nonparticipation) and U.S. region and found that of the 39 states who reported data to CDC, 23 reported fewer than half of the expected numbers of EBLL cases with 11 reporting < 20% of the expected numbers of EBLL cases. Therefore, Roberts et al. (2017) concluded that state health departments need to ensure that providers are aware of state and federal guidelines for BLL testing. Actions that states can take to ensure that providers are aware of and comply with blood lead testing guidelines include educating providers about Medicaid and state testing policies (Dickman, 2017).

Other Requirements

Data sharing among state agencies that play a role in health services for children (state health departments, Medicaid agencies, MCOs, and Special Supplemental Nutrition Programs for Women, Infants, and Children [WIC]) can support efforts to ensure that all at-risk children receive blood lead testing at appropriate ages (Kartika, 2018a). Data sharing and coordination across agencies, as well as with MCOs, to assess the risk of lead poisoning at the local level can improve testing rates by assisting with the identification and development of the most appropriate jurisdiction-specific testing recommendations and policies (GAO, 1999). Lead testing registries are a valuable tool because they identify which providers and laboratories are not adhering to state health department reporting requirements for childhood BLLs (Honsberger et al., 2018). Another tactic that states can employ to encourage blood lead testing is requiring proof of blood lead tests as a condition for school enrollment (Dickman, 2017). However, most states do not enforce this requirement. Additionally, most children enter school around ages 5 or 6 years old, after the required Medicaid testing ages of 1 and 2 years old and beyond the timeframe when children are most vulnerable to the harmful effects of lead.

Examples of State-Specific Strategies to Increase Childhood Blood Lead Testing

California

A 2020 audit of California's childhood lead poisoning data found that less than 27% of Medicaid-eligible children received a blood lead test (California State Auditor, 2020). Unfortunately, the report found that many of these children live in areas at high risk for EBLLs. The state Department of Health Care Services (DHCS) is developing two approaches to address this problem: 1) a performance standard for measuring whether managed care plans, which provide health care for low-income children in California, are conducting required blood lead tests with a specific focus on 1- and 2-year-old children and 2) a financial incentive program for administering blood lead tests. To increase testing rates in the short term before these two approaches are fully in effect and enforced, DHCS plans to raise awareness among providers of the need to test children and require health care plans to identify children who have not been tested.

Illinois

About 75% of the housing stock in Illinois was built before 1978 and is likely to contain some lead-based paint, and the state ranks high in rates for the number of children with EBLLs compared with other states (Illinois Department of Public Health [IDPH], 2020). However, only about 12% of Illinois children <6 years of age were tested in 2017, and 3% had EBLLs. Illinois law requires licensed providers and other health care facilities (i.e., health departments, MCOs) to conduct blood lead testing for children from 6 months to <6 years of age who live in high-risk zip codes; are eligible or enrolled in Medicaid, Head Start, All Kids (Illinois' CHIP) or WIC programs; have a sibling with an EBLL; lives in or regularly visits a pre-1978 home; have been exposed to a renovation or repair in a pre-1978 home; are a refugee or international adoptee; have been to a country where exposure to lead is likely; live with someone whose job or hobby involves exposure to lead; or live near a facility that uses lead (Boufides et al., n.d.; Illinois Department of Health, n.d.). Additionally, licensed schools and childcare facilities require parents to submit a statement from a health care provider confirming that the child has been tested for lead. Moreover, health care providers are obligated to test for lead poisoning during school health examinations if the provider judges the child to be at-risk (Boufides et al., n.d).

Indiana

Despite Indiana having a Superfund site with a lead hazard and almost two-thirds of the state's housing stock built before 1978, which most likely contains lead-based paint, only 10% of children <6 years of age in Indiana received a blood lead test in 2017 (CDC 2019b; Kartika, 2018a). Therefore, Indiana is interested in increasing its testing rates and is employing several strategies to ensure that providers are conducting childhood blood lead testing. These include linking incentive payments to a HEDIS-based performance metric for MCOs in 2018; monthly data sharing between the state health department's lead registry and their MCOs; and issuing provider guidelines requiring an initial blood lead test at the six-month visit for high-risk children enrolled in Medicaid in addition to federal Medicaid testing requirements (Kartika, 2018a).

Maryland

Over 1.2 million residences in Maryland are estimated to contain lead-based paint because they were built before lead paint was banned for residential use (U.S. Census, n.d.). In 2017, about 30% of Maryland children <6 years of age received a blood lead test, and 1.2% of them had EBLLs (CDC, 2019a). One way that Maryland seeks to continue their statewide trend of significantly reducing childhood lead poisonings is by implementing strategies aimed at identifying lead-exposed children (Lent and Cooper, 2019). To increase childhood blood lead testing rates, Maryland has a comprehensive, cross-agency two-pronged policy approach consisting of an MCO incentive metric and Medicaid MCO requirements (Lent and Cooper, 2019). The incentive metric uses a VBP for Maryland’s Medicaid MCOs by linking financial incentives to health care providers' performance on testing blood lead levels in children ages 12 to 24 months. Additionally, in 2018, Medicaid MCOs initiated a lead testing performance improvement project (PIP) that included member education, in-home lead testing, and provider feedback and incentives. To measure increases from baseline data, the HEDIS and the Maryland encounter data measure are used to evaluate changes in the percentage of children who had at least one capillary or venous blood lead level test by age two years and the percentage of children ages 12 to 23 months who were tested for lead during the past two years, respectively.

Ohio

Although > 67% of Ohio's housing stock was built before 1980 and therefore likely to contain some interior or exterior lead-based paint, only approximately 19% of Ohio children were tested for lead in 2017, and 2.9% had EBLLs (CDC, 2019a; Ohio Department of Health, n.d.). To ensure that all Ohio children <6 years of age at risk of lead poisoning are tested, the state uses regulatory and other strategies. The following criteria define at-risk for Ohio children: being Medicaid-eligible; living in a high-risk zip code; living in or regularly visiting a residence, childcare facility, or school built before 1950 or 1978 if the structure has deteriorated paint or recent renovations; having a sibling or playmate who has or had lead poisoning; frequent contact with an adult who works with lead or uses it in a hobby; and living near an industry that generates lead dust (Boufides et al., n.d.;. Ohio Department of Health, 2018). The onus is on primary health care providers in Ohio to ensure that state regulations for childhood blood lead testing are followed (Boufides et al., n.d.). Although state CHIPs do not require universal lead testing, children covered under Ohio's CHIP program must also receive a blood lead test as described in the Medicaid policy (CMS, 2016; Medicaid.gov, 2010).

Rhode Island

Rhode Island children are at high risk for childhood lead poisoning because 80% of the state's housing stock was built before 1978 and is likely to contain lead-based paint (Kartika, 2018b). However, about 39% of Rhode Island children <6 years of had a blood lead test in 2017, and of these, 3.2% had an EBLL (CDC, 2019a). To identify childhood with EBLLs, Rhode Island uses a mix of statewide strategies, including metrics and incentives, provider guidelines, mandatory reporting and data sharing, and requirements for schools, childcare facilities, and foster homes. In 2015, Rhode Island began developing value-based contracting measures that that would be used by all payers in the state, which included metrics for lead testing; the lead metrics were also available to be adopted by the state Medicaid agency (Kartika, 2018b). State Medicaid MCOs are eligible to participate in a performance-based incentive program to earn additional payments by meeting at least the 90th percentile for the HEDIS lead screening measure of testing children by their 2nd birthday with one or more capillary or venous lead blood tests; partial payments are awarded to MCOs that meet at least the 75th percentile of the HEDIS measure.

In addition to federal Medicaid testing guidelines, Rhode Island requires that all children receive at least two blood lead tests by three years of age regardless of their risk level or type of health insurance (Kartika, 2018b). As required by law, BLL testing results must be reported to the state health department within ten days (State of Rhode Island Department of Health, 2020). Results are then uploaded into KIDSNET, the state's integrated child health information system that incorporates data from 10 public health programs and helps providers identify which patients need a blood lead test; Rhode Island is working towards linking KIDSNET data to the state's health information exchange (Kartika, 2018b; State of Rhode Island Department of Health, 2020a). Rhode Island has taken additional steps to increase testing rates by requiring a statement from a health care provider indicating that a child has received a blood lead test in accordance with the state’s Lead Poisoning Prevention Act before enrolling in public and private kindergartens, daycare centers, preschools, early childhood education programs, and other childcare facilities; however, non-tested children are still allowed to enroll in and attend school since lead poisoning is non-communicable (Kartika, 2018b; State of Rhode Island Department of Health, 2020b).

Methodological Considerations

Childhood blood lead poisoning became the first noninfectious condition to be voluntarily nationally notifiable in 1995 as part of CDC's National Notifiable Diseases Surveillance System (CDC, 1996). According to CDC, public health surveillance is the "ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health" (CDC, 2001). The multiple and varied uses of surveillance data include estimating the magnitude and distribution of specific diseases or public health problems; gaining a better understanding of the natural history of a disease; generating research hypotheses; estimating disease burden and monitoring changes and trends; providing critical information for disease management, planning public health programs, public health policy, and practice; and evaluating interventions and policies (Institute of Medicine [IOM], 2011; Soucie, 2012; Stroup et al., 2015). While surveillance is not considered research, the data collected via surveillance systems can serve as the foundation for research and a tool for strengthening evidence-based decisions (Nsubuga, 2006; Stroup et al., 2015).

Analyses of surveillance data entail cross-sectional descriptive statistics, determining if subpopulations have a higher risk, identifying disparities, and evaluating associations between adverse public health outcomes and risk factors so that interventions and policies can be developed to address disparities and mitigate risk; continued collection and analysis of surveillance data can then be used to assess the effectiveness of implemented interventions and policies (Soucie, 2012; Stroup et al., 2015). Examples of using surveillance data to develop and/or evaluate interventions and policies include evaluating the effectiveness of isolation activities for Ebola in Africa and national vaccination days to eliminate polio; recommending that healthcare providers advise women of childbearing age to take folic acid to prevent neural tube defects; and assessing the effectiveness of interventions to control obesity using CDC's Behavioral Risk Factor Surveillance System (BRFSS) (Nsubuga, 2006; Stroup et al., 2015). The study used surveillance data to focus on evaluating policies and determining best practices.

CHAPTER THREE

METHODS

Study Design

This dissertation is a secondary analysis using an ecological study design. An ecological study design is the most appropriate option, given that data are available at the population level (Morgenstern, 1995). To assess if there is an association between childhood blood lead testing rates (dependent variable) and state-level childhood lead poisoning testing policies/strategies (independent variable), an inclusive dataset was constructed using data from three sources: number and proportion of children <6 years of age who are tested for childhood lead poisoning according to 2017-2018 data reported to CDC's Childhood Blood Lead Surveillance (CBLS) system, the previously described NASHP/MCEH COIIN report that summarizes state policies that promote lead testing for children, and U.S. Census data. Data on potential confounders was obtained from the U.S. Census. Data on 2017-2018 blood lead testing rates from CBLS were chosen because the NASHP/MCEH COIIN report was published in 2018. Therefore, information collected for the report likely reflects the policy/strategy landscape in 2017, and 2018 is the most recent year that complete CBLS data are available.

Study Population

The CDC hosts and manages the passive CBLS system whose core strategies are designed to strengthen blood lead testing and reporting; surveillance; linkages of lead-exposed children to recommended services; and targeted, population-based interventions (CDC, 2019b). The CBLS system collects standardized, partially identifiable childhood lead testing data from funded programs. In 2017-2018, CDC funded 53 programs to participate in childhood blood lead surveillance. However, only 34 of these programs (32 states, New York City, and the District of Columbia, which was considered a state for this analysis) are included in the primary analysis because complete data for 2017-2018 are available for the entire jurisdiction covered by the state's childhood lead poisoning prevention program. CBLS data from New York City and New York state were merged before analysis. Programs included in the analysis are shown in Figure 2. Public health surveillance data do not require patient consent (Bernstein & Sweeney, 2012). In 2018, the 53 funded programs reported data on blood lead testing for 3.3 million children (CDC, personal communication, July 15, 2021).

Data Collection Procedures

Although programs collect laboratory and clinician-reported BLL test results on children < 16 years of age that are reported to participating state or local CLPPPs, the focus of CBLS and this study is on children less than six years of age because this age group is more vulnerable to lead since their bodies are growing and developing rapidly, and children in this age group exhibit hand to mouth behavior which is likely to result in ingesting lead-contaminated dust from hands or other objects (CDC, 2021d. A childhood blood lead test is defined as "Any blood lead draw (capillary, venous or unknown sample type) on a child <16 years of age that produces a quantifiable result and is analyzed by a Clinical Laboratory Improvement Amendments (CLIA)-certified facility or an approved (CLIA waived) portable device" (CDC, 2021e). Programs submit data quarterly, and CBLS data are thoroughly validated and checked for errors according to established protocols to ensure that a child is counted only once in the surveillance system for each year in which they are tested. However, a child may be included in the dataset twice if they received a blood lead test in both years analyzed.

Qualitative data were collected to understand better why states implemented a low versus a high number of state-level childhood lead poisoning testing policies/strategies. Five states with one testing policy/strategy, one state with four strategies, and three states with five testing policies/strategies were invited to respond to three questions (Appendix C).

Datasets

Variables captured by the CBLS system include a unique child identifier; program identifier; reporting year; address identifier; geographic information (city, state, zip code, county FIPS code, and census tract of the child's primary residence); child's date of birth, sex, race and ethnicity; type of insurance (public, private, self-pay); source of the lead (paint, traditional medicines; take-home occupational exposure; hobby; pottery); if the child was chelated and if so the type of chelation; information about the child's primary residence (year built, if it was renovated and dates if applicable, if the home is owned or rented, type of dwelling, length of time at residence, details about chipping paint if applicable); if an environmental investigation was conducted and information on lead levels in various surfaces and media in the home; if remediation was completed if needed; and information on the blood lead test (date taken, result in ug/dL, type of test [venous or capillary], reason for the test, type of lab performing test) (CDC, 2015a). The state childhood lead poisoning prevention programs do not routinely obtain social security numbers. Reporting criteria, such as the BLL that should be reported and who should report the data, vary across jurisdictions; generally, health care providers initiate the testing, and clinical laboratories and providers report all BLL data to their state health department (CDC, 2019a). Most of the data are securely electronically transmitted, although some providers and laboratories still securely fax information to the state health department.

All states have at least one childhood lead poisoning testing policy/strategy, but no states used all the reported approaches. Community and individual-level risk factors for EBLLs in children are well-established (Bernard & McGeehin, 2003; Lanphear et al., 1998; Wengrovitz & Brown, 2009). EBLLs in children are independently associated with living in an urban area, living in housing built before 1978, being Black, being eligible for Medicaid, and living in areas with higher poverty rates and lower percentages of high school graduates. EBLLs are not just a problem for impoverished, inner-city minority children, as living in housing built before the 1978 lead paint ban is one of the strongest risk factors. Being foreign-born is also a risk factor for childhood lead poisoning because 1) exposure is more common in countries outside the United States and 2) foreign-born people are more likely to use products from other countries that contain lead (Hore et al., 2017).

As previously stated, providers are more likely to test BLLs in children when their practice serves a larger proportion of young children who were enrolled in Medicaid and a larger number of children identified in the past five years with an EBLL (Kemper & Clark, 2005; Keeshan et al., 2010). Based on this and information from the literature review on other key risk factors for EBLLs which are likely to influence a providers' decision to test children's blood for lead, data on the following potential confounders (percentages) were obtained from the U.S. Census data for 2017 for each state included in the analysis: housing built before 1980, Black alone or in combination with other races, foreign-born, persons ages 25 years and older with at least a high school diploma, and population under six years of age with Medicaid coverage (U.S. Census Bureau, n.d.).

Data Handling and Record-Keeping

During 2017-2018, programs removed the child's name and address before securely electronically transmitting CBLS data to CDC via secure email, secure web login, or encrypted secure file transfer protocol (FTP) sites. However, CBLS does collect potentially sensitive data and other personally identifiable information (PII) (e.g., child's birthdate, sex, race, and ethnicity), and this information must be kept private, confidential, and secure (CDC, 2019a). Only explicitly authorized CDC staff have access to the data for editing and processing. As required by CDC, a data management plan was created for CBLS that describes how CBLS data will be released and shared with the public in compliance with CDC policy and other applicable federal laws and rules. Only aggregate data are reported and made publicly available because some PII is collected, and there are small numbers for some of the variables, which could make identification possible. Although there is minimal risk to privacy, a variety of safeguards are in place to minimize such risk as described in the applicable Privacy Act System of Records Notice (SORN 09-20-0136 "Epidemiologic Studies and Surveillance of Disease Problems") such as controlled access to CDC facilities, nightly computer system backups, verification to access computer files (username and password), and virus protection (CDC, 2012). The combined dataset constructed for this analysis was kept private, secure, and confidential according to CDC policies and procedures described above.

Data Analysis

To calculate the dependent variable "childhood blood lead testing rates," state populations of children <6 years of age were obtained from the U.S. Census (U.S. Census, 2021). Since population data are provided for age < 5 years and ages 5-9 years, state populations for age <6 years for 2017 and 2018 were estimated by using data for age < 5 years in that year and adding 0.2*(number for ages 5-9 years). The proportion of children tested during the study period 2017-2018 was calculated by dividing the average of the numerators (the numbers of children tested) by the average of the denominators (population <6 years of age) and for the two years.

The “other requirements” category was further classified into meaningful subcategories: mandatory reporting of BLL test results to state health departments, data sharing between Medicaid and other state agencies, and requiring proof of blood lead tests as a condition for school enrollment. The other strategies included in the "other requirements" category were not focused on testing (e.g., home visits, case management, environmental assessments) or only one or two states were implementing the policy (e.g., providing lead information to pregnant women, CHIP funded lead education that included testing). The total number of policies/strategies a state could have was seven, but no states implemented all these categories.

SAS 9.4 was used to analyze the data (SAS Institute Inc., 2013). Relevant characteristics and descriptive statistics of the included states are presented. The primary analysis assessed which particular policy/strategy or combination thereof (lead testing metrics, lead testing incentives, other MCO guidance, provider guidelines in addition to federal Medicaid requirements, mandatory reporting of BLL test results to state health departments, data sharing between Medicaid and other state agencies, and requiring proof of blood lead tests as a condition for school enrollment) is associated with the highest proportion of children <6 years of age tested for childhood lead poisoning. Variables that were combinations of the policies/strategies with the highest regression coefficients were created to explore if a particular grouping was associated with higher childhood blood lead testing rates. For example, “metrics and provider guidelines” was assessed as the independent variable in the unadjusted and adjusted models. More sophisticated statistical methods to assess combinations of policies/strategies could not be conducted because data were too sparse. The total number of policies/strategies was also modeled.

Modeling was conducted to assess the associations. Childhood blood lead testing rates were assessed as a continuous dependent variable using linear regression to compute regression coefficients, 95% confidence intervals (CIs), and p-values for unadjusted models and models that individually adjusted for each potential confounder. Fully adjusted models were also conducted on the a priori identified risk factors from the literature review. Confounding was evaluated using a 10% change in the estimate rule (Maldonado & Greenland, 1993). If the regression coefficients for the childhood blood lead testing rates differed by ≥10% in the unadjusted and adjusted models for most of the policies/strategies, then the risk factor was included in a fully adjusted model. Pearson correlations among potential risk factors were conducted to assess collinearity and help determine which variables to include in the fully adjusted model.

Sensitivity analyses were conducted by including five additional states who participated in CBLS but whose 2017-2018 surveillance data were incomplete or unavailable in CDC's cleaned and edited dataset. For these five states, 2017 data on childhood blood lead testing rates were available from the states’ websites; 2018 data were unavailable. Therefore, the sensitivity analyses only included 2017 childhood blood lead testing rates.

Modeling childhood blood lead testing rates as a categorical variable was also explored. Odds ratios could not be calculated using cut points at the 90th or 75th percentiles of childhood blood lead testing rates because data were too sparse. When using a cut point at the 50th percentile, states with very different childhood blood lead testing rates were grouped together; for example, Massachusetts and Oklahoma, which had testing rates of 48% and 17%, respectively. Discretizing continuous data into categorical variables at optimal cut points must balance accuracy and consistency and can be problematic when the data do not display definitive increases or decreases around threshold values (Williams et al., 2006). If inappropriate cut points are chosen, measures of effect can be over- or underestimated and there can be a loss of information making it difficult to replicate findings in subsequent studies (Williams et al., 2006). In addition to some of these models not converging because of small cell sizes, model results had very wide CIs indicating a lack of precision in the point estimate or conflicted with the results of the linear regression models. Linear regression models were used as they were not affected by grouping dissimilar testing rates which occurred with logistic regression and may be misleading.

Ethics

The CBLS system was exempt from CDC's Institutional Review Board (IRB) review and approval because it is public health practice surveillance data, but the data collection was approved by the Office of Management and Budget (OMB) because data are collected from more than nine entities. No ethical concerns are expected because the study is a secondary data analysis and is consistent with the CBLS core strategy for which the data were collected of strengthening blood lead testing and reporting, the dataset that was constructed does not contain PII, and results will be shared with key stakeholders so that appropriate actions can be taken (Bernstein & Sweeney, 2012; CDC, 2019b; Klingler et al., 2017). CDC determined that IRB approval was not needed using the justification that it is "Research Not Involving Human Subjects," and the University of Georgia's IRB concurred.

Interpretation of Results

Statistical significance testing was not used to interpret results in this analysis because a qualitative decision about the public health importance of a result should not be based on using an arbitrary cutoff for "significance" (e.g., $p < 0.05$ or a 95% CI that does not include the null value) (Rothman et al. 2008; Stang et al. 2010). Results in this analysis were interpreted using guidance on page 163 in Modern Epidemiology, 3rd edition, which recommends avoiding using statistical hypothesis testing because it may promote misinterpretation (Rothman et al. 2008). Critical consideration of both statistically and non-statistically significant point estimates in conjunction with other relevant factors should form the basis for interpreting epidemiological results with a focus on the magnitude of the point estimate (Greenland et al., 2016; Hill, 1965). These factors include width of the confidence interval (as a proxy for the precision of the estimate), model assumptions, uncertainties, evaluation of biases (e.g., exposure misclassification and confounding), and Hill's viewpoints for causality (particularly consistency with previous findings). When considering other contextual factors, a non-statistically significant result may still provide useful information for public health action. Conversely, a statistically significant result may lack scientific and public health significance (Fedak et al., 2015; Porta, 2014). Therefore, results from this analysis were interpreted based on the magnitude of the point estimates (regression coefficients) and coherence (Fedak et al., 2015; Hill, 1965).

CHAPTER FOUR

RESULTS

Figure 2 displays the states included in the primary (n=33) and sensitivity (n=38) analyses. Ten states were excluded from the primary analysis because of incomplete childhood blood lead testing data for 2017-2018 (Delaware, Florida, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Virginia, and Texas). Additionally, eight states were not included in the analyses because they did not participate in the CBLS system during 2017-2018 (Arkansas, California, Idaho, Montana, North Dakota, South Dakota, Utah, and Wyoming).

Table 1A presents the distribution of lead-related policies and strategies and the proportion of children <6 years of age tested for BLLs in 2017-2018 by state included in the primary and sensitivity analyses. The number of policies and strategies per state ranged from one to five, with an average of three policies/strategies per state. The most frequent policy/strategy was provider guidelines (n=35) followed by mandatory reporting of testing data to a state health department (n=23), metrics (n=20), and incentives (n=14). Table 1B presents the distribution of lead-related policies and strategies for the 13 states excluded from the primary and sensitivity analyses. The number of policies and strategies per state in the states excluded from the analyses ranged from zero to three, with an average of one policy/strategy per state. The most frequent policy/strategy was provider guidelines (n=9) followed by metrics (n=4). Additionally, none of the excluded states used data sharing between Medicaid and other state agencies or requiring proof of blood lead tests as a policy/strategy to increase the proportion of blood lead testing in children. The proportion of children <6 years of age tested for BLLs in 2017-2018 in these states was unknown.

The most frequent combination of childhood blood lead testing policies/strategies enacted by states included in the analysis was provider guidelines and mandatory reporting of testing data to state health departments (n=21) followed by provider guidelines and metrics (n=17). States were reported to use the following combinations of policies/strategies nine times each: provider guidelines, metrics, and incentives; provider guidelines and MCO guidelines; and metrics and incentives. Additionally, seven states were reported to have the combination of provider guidelines, mandatory reporting of testing data to state health departments, metrics, and incentives.

The proportion of children <6 years of age tested for BLLs in 2017-2018 in states included in the analysis ranged from 0.04 to 0.48 with an average of 0.17. Where indicated, data on the proportion of children tested were included for the five additional states included in the sensitivity analyses of 2017 data only (Delaware, Louisiana, Indiana, Michigan, and Texas).

Table 2 presents the distribution of potential confounders by state included in the primary and sensitivity analyses. The percentage of the population that was African American/Black race alone or in combination with other races ranged from 1.8% to 47.5%, with an average of 9.4%. The percentage of the population with persons ages ≥25 years with at least a high school diploma ranged from 84.4% to 93.1%, with an average of 89.9%. The percentage of the population <6 years of age with Medicaid coverage ranged from 33.8% to 62.2%, with an average of 42.2%. The percentage of the population who lived in housing built before 1980 ranged from 24.0% to 77.3%, with an average of 54.6%. The percentage of the population that was foreign-born ranged from 1.6% to 22.9%, with an average of 8.7%.

The percentage of the population with persons ages ≥25 years with at least a high school diploma was highly negatively correlated with the percent of the population <6 years of age with Medicaid coverage (r=-0.66, p<0.01) (Table 3). Therefore, percentage of the population with persons ages ≥25 years with at least a high school diploma was excluded from fully adjusted models based on information in the literature indicating that providers use the percentage of their patient population enrolled in Medicaid to make decisions about blood lead testing (Kemper & Clark, 2005; Keeshan et al., 2010). The data did not show a correlation between race and pre-1980 housing or between race and population <6 years of age with Medicaid coverage.

Primary Analyses

Unadjusted results for the proportion of children tested for BLLs in 2017-2018 are presented in Table 4. Regression coefficients ranged from 0.03 for mandatory reporting of childhood blood lead tests to state health departments to 0.12 for requiring proof of blood lead testing for school enrollment. Results of associations between blood lead testing policies/strategies, and the proportion of children tested for BLLs in 2017-2018 individually adjusted by one potential risk factor are shown in Table 5. Models were fully adjusted for the following confounders based on the a priori literature review and results from comparing unadjusted and adjusted regression coefficients to determine if they differed by >10%: percentages of the population living in housing built before 1980, population <6 years of age with Medicaid coverage, and foreign-born. The other potential risk factors (percentages of the population African American/Black and persons ages ≥25 years with at least a high school diploma) did not appreciably vary the regression coefficients and were therefore excluded from the adjusted models. In the fully adjusted models (Table 6), metrics had the highest regression coefficient (0.06, 95% CI 0.01, 0.11; p=0.01) followed by other MCO guidance (0.04, 95% CI -0.03, 0.11, p=0.28) and mandatory report of childhood blood lead testing results to state health departments (0.04, 95% CI -0.01, 0.09, p=0.08).

Tables 7-10 present unadjusted and adjusted results of associations between combinations of policies/strategies and the proportion of children tested for BLLs in 2017-2018. Combinations were selected based on the policies/strategies with the highest regression coefficients in the unadjusted and adjusted models. In the unadjusted models, the highest regression coefficients were for requiring proof of childhood blood lead testing for school enrollment (0.12, 95% CI 0.01, 0.23, p=0.03), other MCO guidance (0.10, 95% CI 0.01, 0.18, P=0.03), and metrics (0.07, 95% CI 0.00, 0.21, p=0.06). Metrics had the highest regression coefficient in the adjusted models, followed by other MCO guidance and mandatory reporting to state health departments. States that required proof of childhood blood lead testing for school enrollment and used metrics had the strongest unadjusted regression coefficient (0.16, 95% CI 0.04, 0.28, p<0.01) (Table 7). However, when confounders were included in the model, the regression coefficient was 0.05 (95% CI -0.05, 0.15, p=0.30). For MCO guidance combined with other policies and strategies, the strongest regression coefficient was when states provided other MCO guidance and used metrics (0.13, 95% CI 0.04, 0.23, p=0.01) (Table 8). After adjustment, the regression coefficient was 0.08 (95% CI 0.00, 0.15, p=0.04). For metrics combined with another policy/strategy, the strongest regression coefficient was observed for states that used metrics and distributed provider guidelines (0.09, 95% CI 0.02, 0.16, p=0.01) (Table 9). After adjustment, the regression coefficient was 0.08 (95% CI 0.03, 0.12, p<0.01). For mandatory reporting of childhood blood lead results to state health departments combined with another policy/strategy, the strongest regression coefficient was observed for states that required mandatory reporting of results and incentives (0.07, 95% CI -0.01, 0.15, p=0.10) (Table 10). After adjustment, the regression coefficient was 0.01 (95% CI -0.05, 0.08, p=0.63). An adjusted regression coefficient of 0.05 was observed for states that required mandatory reporting to state health departments and distributed provider guidelines (95% CI 0.00, 0.10, p=0.07).

The unadjusted regression coefficient for a model that combined proof of testing for school enrollment, MCO guidance, and metrics was 0.07 (95% CI -0.15, 0.29, p = 0.53). After adjustment, the regression coefficient for combining all three of these policies/strategies was 0.02 (95% CI -0.14, 0.17, p = 0.81). However, only one state (Iowa) had all three of these policies.

Sensitivity Analyses

Unadjusted results for the proportion of children tested for BLLs in 2017 are presented in Table 11. Regression coefficients ranged from 0.03 for mandatory reporting of childhood blood lead tests to state health departments to 0.07 for requiring proof of blood lead testing for school enrollment. Results of associations between blood lead testing policies/strategies and the proportion of children tested for BLLs in 2017 individually adjusted by one potential risk factor are shown in Table 12. Models were fully adjusted for the same confounders used in the primary analyses based on the a priori literature review and results from comparing unadjusted and adjusted regression coefficients to determine if they differed by >10%: percentages of the population living in housing built before 1980, population <6 years of age with Medicaid coverage, and foreign-born. In the fully adjusted models (Table 13), metrics had the highest regression coefficient (0.04, 95% CI -0.01, 0.08; p=0.11) followed by mandatory reporting of childhood blood lead testing results to state health departments (0.03, 95% CI -0.01, 0.08, p=0.17).

Tables 14-17 present unadjusted and adjusted results of associations between combinations of policies/strategies and the proportion of children tested for BLLs in 2017. Combinations were selected based on the two policies/strategies with the highest regression coefficients in the unadjusted and adjusted models. In the unadjusted models, the highest regression coefficients were observed for requiring proof of childhood blood lead testing for school enrollment and other MCO guidance. Metrics had the highest regression coefficient in the adjusted models, followed by mandatory reporting to state health departments. States that required proof of childhood blood lead testing for school enrollment and used incentives had the strongest unadjusted regression coefficient (0.14, 95% CI 0.02, 0.26, p=0.03) (Table 14). However, when confounders were included in the model, the regression coefficient was -0.01 (95% CI -0.11, 0.10, p=0.90). For MCO guidance combined with other policies and strategies, the strongest regression coefficient was when states provided other MCO guidance and used metrics (0.09, 95% CI 0.00, 0.17, p=0.04) (Table 15). After adjustment, the regression coefficient was 0.04 (95% CI -0.02, 0.10, p=0.21). When states combined metrics with other policies/strategies, an adjusted regression coefficient 0f 0.07 was observed for metrics with provider guidelines and metrics with mandatory reporting of childhood blood lead testing results to state health departments (Table 16). When mandatory reporting of childhood blood lead testing results to state health departments was combined with other policies/strategies, the strongest regression coefficient was 0.06 for mandatory reporting and incentives (95% CI -0.01, 0.14, p=0.10); after adjustment, the regression coefficient was 0.02 (95% CI -0.04, 0.07, p=0.59) (Table 17). Models analyzing associations for three policies were not conducted because several policies and strategies were tied for the third-highest regression coefficients.

Qualitative Analyses

Of the nine states who were surveyed to gain a better understanding of the reasons why states implemented a low versus a high number of state-level childhood lead poisoning testing policies/strategies, seven (77.8%) responded: five states with one policy/strategy and two states with five policies/strategies. Among the two states with five policies/strategies, reasons given for implementing a varied set of policies/strategies to promote childhood blood lead testing were universal testing requirements, having a more stringent state metric compared to federal HEDIS measures, having a high percentage of housing built before 1978 as well as a legacy of industrial lead pollution, and support from an active state AAP chapter; each of these was reported once. Additional efforts planned or being explored to further increase testing rates in these two states include increased education and outreach to providers, forming a subcommittee to assess best practices to increase testing, sending text messages to parents/caregivers to remind them of appointments, data sharing with WIC, adding HEDIS measures to provider report cards that present data on lead testing performance, and enforcement.

Among the five states with only one policy/strategy, barriers to implementing additional policies/strategies were lack of resources (n=4), lack of interest from decision-makers (n=3), linkages between agencies not fully developed (n=2), and attitude among providers that childhood lead poisoning is not an issue in their area (n=1). New efforts underway or being explored in these five states to increase childhood blood lead testing rates include data sharing among state agencies (n=4), new or additional provider guidelines (n=3), enacting legislation to require universal testing statewide or in certain populations (i.e., refugee children) (n=2), offering an incentive (n=1), requiring mandatory reporting of childhood BLL test results to the state health department (n=1), changing MCO guidance for metrics from HEDIS measures to CMS measures (n=1), and analyzing testing rates using lead registry data (n=1).

CHAPTER FIVE

DISCUSSION AND CONCLUSION

Discussion

Data on the proportion of children <6 years of age tested for blood lead are estimated in Table 1A and should not be considered as absolute numbers. This is because denominators included all children in the state estimated to be <6 years of age, and numerator data represented blood lead testing in children which is typically focused on one- and two-year-old children. This may help explain why testing rates appear to be low.

Besides Medicaid coverage, data on risk factors shown in Table 2 represented the entire population of the state and were not limited to children <6 years of age and therefore may not accurately capture the true distribution of risk in young children. The percent of the population living in pre-1980 housing does not account for housing that has been renovated and no longer presents a lead hazard to children. The lack of a correlation between the percent of the population who is African American/Black and who lived pre-1980 housing and between African American/Black and population < 6 years of age with Medicaid coverage observed in Table 3 was unexpected.

Both the unadjusted and adjusted results in Tables 4-10 provide useful information. Unadjusted results are also highlighted because of concerns of correlations among the risk factors and including too many variables in adjusted models when data are limited by the small number of states analyzed. The reason why African American/Black race did not appear to be a confounder in this analysis is likely because race is not directly related to the blood lead testing strategies/policies. Race may be indirectly related to policies/strategies that prioritize at-risk children from low-income households such as metrics, incentives, MCO guidance, provider guidelines, and sharing Medicaid data with state health departments. Additionally, since healthcare providers may have differentially tested children's blood for lead based on their race, race may be an effect modifier, (Vander Weele, 2012). In this situation, race would be an effect modifier if the magnitude of the association between childhood blood lead testing rates and policies/strategies to promote blood lead testing varied depending on the child's race (Kamangar, 2012). To determine if effect modification is present, the associations between testing rates and policies/strategies would need to be computed separately for each race. However, this stratified analysis could not be conducted because data were not available for race of the children in the study population. To the author's knowledge, no policies to promote childhood blood lead testing focus only on race. CDC is planning to release a Lead Exposure Risk Index (LERI) interactive mapping tool by the end of 2021 which will assist healthcare providers in determining which communities are at higher risk for lead exposure so that at-risk children can receive a blood lead test and appropriate follow up care (Egan et al., unpublished). Race is one of ten factors that are included in the index's composite score.

As shown in Tables 4 and 11, requiring proof of childhood blood lead testing for school enrollment produced the strongest unadjusted regression coefficients in both the primary and sensitivity analyses, which suggests that this policy is an important lever to promote increased childhood blood lead testing. According to the NASHP/MCEH COIIN document, only five states currently use this approach (NASHP/MCEH COIIN, 2019). Enacting and enforcing the policy requiring proof of blood lead testing for school enrollment is likely to overcome the challenges providers face when they schedule testing appointments and parents and caregivers either decline or miss appointments (Office of Inspector General, 2021). This is because there will be a strong disincentive for parents and caregivers who do not follow up on recommended childhood blood lead testing appointments. As shown in Tables 6 and 13, required reporting of the HEDIS metrics for lead (the percentage of children two years of age who had one or more capillary or venous lead blood tests for lead poisoning by their second birthday) produced the strongest adjusted regression coefficients in both the primary and sensitivity analyses (NCQA, 2020b). Slightly more than 50% of the states used metrics to increase childhood blood lead testing.

As expected, higher proportions of childhood blood lead testing were associated with states who used a multipronged approach to promote increased childhood blood lead testing. When combinations of policies and strategies were assessed, the strongest unadjusted regression coefficient in the primary analysis was observed for states that required proof of blood lead testing for school enrollment and metrics as shown in Table 7. When models combining policies and strategies were adjusted, the strongest regression coefficients were a tie between “metrics and MCO guidance” and “metrics and provider guidelines” as shown in Tables 8-9.

In the sensitivity analysis, the strongest regression coefficient for combinations of policies/strategies was observed for proof of blood lead testing for school enrollment and incentives as shown in Table 14. When models combining policies and strategies were adjusted, the strongest regression coefficients were a tie between “metrics and provider guidelines” and “metrics and mandatory reporting of childhood blood lead testing results to state health departments” as shown in Table 16.

Negative regression coefficients are interpreted as providing no support for the hypotheses that policies and strategies designed to promote childhood blood lead testing increased the proportion of children who received blood lead tests. There is no basis to suggest that a policy or strategy aimed at increasing blood lead testing would be negatively associated with the proportion of children who received blood lead testing observed in this analysis. Negative regression coefficients may be attributed to misclassification as well as random error due to small numbers for discrete endpoints. Additionally, these results may be driven by an outlier, such as a state without a particular policy or risk factor having a high proportion of children who received a blood lead test. Additionally, there were some instances where a small number of states had implemented a particular policy or strategy (or combination of policies and strategies) which resulted in wide CIs, and these results need to be interpreted cautiously.

In October 2021, CDC's Childhood Lead Poisoning Prevention Program was expanded to include an additional eleven states that did not previously participate in CBLS. Therefore, CDC will begin receiving childhood blood lead surveillance data for 48 states which includes data on the proportion of children who receive a blood lead test. A more comprehensive analysis can be conducted in the future to evaluate the effectiveness of state-level policies and strategies on childhood blood lead testing rates that covers almost the entire nation.

Public Health Significance and Implications

This analysis is innovative because it aims to fill an unmet need by providing critical evidence-based information to understand better which policies and strategies (and combinations of approaches) are associated with higher proportions of children receiving blood lead testing. Effective policies and strategies are key to ensuring that all at-risk children are tested and connected to any needed case management or follow-up services. However, varied state laws and policies have made this topic difficult to assess. The identified best practices on specific state policies and strategies to increase the proportion of children who receive blood lead testing will be shared with appropriate stakeholders (policymakers; local, state, and federal public health agencies; professional organizations; non-profit organizations; and others) so actions can be taken to increase childhood blood lead testing.

Given that a substantial proportion of U.S. children did not receive blood lead tests, the true magnitude of children with EBLLs is unknown and likely much higher than currently enumerated (Schneyer & Pell, 2016; Roberts et al., 2017; Neuwirth, 2018). Increasing the proportion of children who receive blood lead testing will help public health practitioners to understand the true distribution of childhood BLLs and allow for resources to be prioritized appropriately, particularly for underserved communities and children at-risk for EBLLs and associated adverse health effects. It is especially important to focus interventions on children at higher risk for EBLLs as they often face many other risk factors (e.g., environmental exposures, racial discrimination, crime, poverty, poor housing conditions, and lack of access to healthcare) that put them at a disadvantage and affect life-long health (Hanna-Attisha, et al. 2016). Increased blood lead testing will result in more complete and accurate blood lead data so that public health professionals, healthcare providers, and communities can better understand dose-response relationships between environmental lead levels and BLLs, which interventions are most effective, and which geographic locations and populations are at high risk of exposure (Health Impact Project, 2017). However, the public and private laboratories that process blood lead testing are likely to require more resources (staff, funding, and training) to manage the increased caseload.

Increasing the proportion of children who receive blood lead testing is likely to change the population-level distribution and prevalence of BLLs by capturing more children with EBLLs. Given that more children with EBLLs are likely to be identified, state health departments and other state agencies that have a role in managing and supporting children with EBLLs (such as housing, nutrition, and education) should plan to allocate additional resources, including both staff and funding, to provide case management and to reduce or eliminate exposure. When children with EBLLs are connected to appropriate behavioral services and early learning interventions, they are more likely to exhibit academic readiness, spend less time in special education, graduate high school, and have reduced contact with the criminal justice system (CDC, 2015b). Investing in programs to mitigate the adverse effects experienced by children with EBLLs is cost-effective from a societal perspective. For example, a recent report estimated that every dollar invested in early childhood education produces $8.60 in benefits to society (CDC, 2015b). However, if the proportion of children tested for blood lead does not increase and consequently children with EBLLs are not identified and connected to services, the costs borne by society are tremendous. It is estimated that lost lifetime earnings range from $165–$233 billion with productivity losses of approximately $267 million due to reduced IQ points from exposure to lead (Dixon et al., 2012; Gould, 2009; Grosse et al., 2002; Health Impact Project, 2017; Minnesota Department of Health, 2019; Nevin et al., 2008). Furthermore, exposure to lead has severe deleterious consequences at the population level. A five-point drop in IQ at the population-level equates to 3.6 million less people with IQs above 130 and 3 million more people with IQs below 70 (Gilbert & Weiss, 2006). IQ losses are even more profound in populations that are underserved and disadvantaged.

Public health policies are a type of intervention that can be enacted and implemented at the local, state, or federal level and have the potential to create sustainable impact and influence for large numbers of people (Poux, 2017). The Social-Ecological Model is a multi-level model (consisting of actions at the individual, interpersonal, community, organizational, and societal/public policy levels) that demonstrates the effect of synergistically maximizing potential prevention and intervention strategies to help solve a complex public health problem such as reducing childhood lead poisoning (CDC, 2020b; Salihuet et al., 2015; Unicef, n.d.). The societal/public policy level examines broad factors for health promotion and includes social and cultural norms as well as health, economic, educational, and social policies that contribute to health and health-related issues (Max et al., 2015). However, it is important to recognize that creating new policies often requires commitments of time, energy, and resources (Golden et al., 2015).

Societal/policy interventions that change the environmental context can be more effective than other public health actions because they require less individual-level efforts (Frieden, 2010). Policy interventions are more likely to be successful when they are supported by subject matter experts, interest groups, community coalitions, and other advocacy groups that monitor policy, as well as the public (Golden et al., 2015). Once a public health policy is enacted, public health professionals are responsible for raising awareness of and promoting the adoption of the policy and its implementation (Golden et al., 2015). Findings from this analysis provide evidence that can be used to support developing additional childhood blood lead testing policies in jurisdictions that have lower proportions of children who receive blood lead testing compared with other similar jurisdictions. Additionally, innovative legislation and policies should be considered to improve childhood blood lead testing proportions and address potential testing barriers. These include requiring private insurance companies to reimburse providers for conducting BLL testing for all at-risk children at 12–24 months of age and offering mobile medical units for blood lead testing when testing cannot be performed at the provider’s office so that children do not miss getting tested due to inability to access off-site testing (Neuwirth, 2018).

Several policies have components that are more specifically aimed at testing at-risk children including metrics, incentives, MCO guidance, provider guidelines, and sharing Medicaid data with state health departments. Metrics rely heavily on the HEDIS measures which are specific to Medicaid-eligible children who qualify based on living in a low-income household. Incentives are often based on providers' HEDIS score and as such are dependent on testing Medicaid-eligible children. MCO guidance allows providers the flexibility to achieve their Medicaid goals. Provider guidelines often includes promoting the Medicaid blood lead testing requirements, disseminating provider report cards to inform providers of their compliance with the Medicaid testing requirements, and providing educational materials that describe jurisdiction-specific at-risk population characteristics (Bruce et al., 2019; Iowa Department of Public Health, 2021; Kentucky Childhood Lead Poisoning Prevention Program, 2006; Washington State Department of Health, 2016). Data sharing between Medicaid and other state agencies, such as health department programs responsible for childhood blood lead surveillance, also encourages testing of at-risk children. Currently, there are efforts underway at the federal and state levels to modernize data sharing among agencies by leveraging existing technologies to create infrastructure to facilitate the transfer of data (Allen, 2021). To build this infrastructure and promote data sharing, the following challenges must be addressed: siloed organizations, the use of multiple and disparate data formats and platforms, and additional resources (funding and staffing) that will be needed (Dixon & Grannis, 2014). As mentioned earlier, some state CLPPPs are already preparing or exploring how to facilitate sharing of data related to childhood blood lead testing in addition to the five states that already implement this policy. States desiring to increase blood lead testing in children at higher risk for EBLLs should consider including at least one of these policies highlighted above.

As demonstrated in the previous paragraph, Medicaid requirements for childhood blood lead testing impacts several policies/strategies. To improve childhood blood lead testing in Medicaid-enrolled children, the Office of Inspector General (OIG) recently published a report that outlines several recommendations for CMS to address the barriers to low testing rates in this population, and CMS concurred (Office of Inspector General [OIG], 2021). These recommendations include targeting states with low testing rates, ensuring consistency across the states on testing definitions, and collaborating with partners to develop and disseminate consistent messaging to state Medicaid agencies. OIG requested that CMS provide details to OIG within 6 months of the date the report was released on the specific actions they will implement along with a timeline and information on costs and benefits. Furthermore, CMS is requested to report details of actions taken, including the date and documentation, within one year from when the report was released.

After findings in this report are shared with appropriate stakeholders and enough time has elapsed for states to adopt and implement additional childhood blood lead testing policies and strategies, a post-implementation evaluation can be conducted. This evaluation can assess what inputs and resources were required to implement the additional policies/strategies, what key activities were conducted during implementation, if increases in the proportion of children receiving a blood lead test were observed, if the policy was implemented consistently for all at-risk children, if there were any unintended consequences, and if there were any external factors that influenced the implementation (CDC, n.d.a; CDC, n.d.b). The economic impact of the policy changes can also be assessed to determine if the new policies are cost effective.

Strengths, Limitations, and Assumptions of the Study

To the author's knowledge, this is the first in-depth nationwide analysis of how policies and strategies to promote childhood blood lead testing are associated with the proportion of children who received blood lead tests. Strengths of this study design include the ability to analyze large numbers of children tested; the ability to evaluate the impact of public health strategies; convenience because of conducting a secondary data analysis; being inexpensive and faster relative to other types of studies; and a lack of ethical issues common to public health studies (autonomy, privacy, and confidentiality) since the study relies on surveillance data (Thiese, 2014; Cataldo et al., 2019; World Health Organization, 2017).

Limitations of the analyses include the inability to include childhood blood lead testing data from states not participating in CDC's CBLS system or states whose data were submitted to CDC but were incomplete; loss of data resolution/inability to attribute associations at the individual level; difficult to infer causality; unmeasured confounding; and potential misclassification such as some of the population may have received a blood lead test in a neighboring state that had different policies, strategies, and guidelines (CMS, 2016; Morgenstern, 1995; Thiese, 2014). Most states in the Great Plains were not represented in this analysis, mainly due to their nonparticipation in CDC's CBLS system. Additionally, even if a provider recommends that a child receive a blood lead test, parents may face barriers to getting their child tested, such as transportation or scheduling issues or not being concerned about or understanding the risk of lead poisoning (Boufides et al., n.d.).

The analysis assumes that the NASHP/MCEH COIIN summary document of state childhood lead-related policies that promote lead testing is comprehensive and accurate and did not omit any important state levers. It is unknown when each state policy or strategy was implemented, and this may affect testing rates; for example, providers who may be more likely to conduct childhood blood lead testing in states with longer-standing policies and strategies. However, there is generally a period between when a childhood blood lead testing law, policy, or strategy is created or enacted and when they take effect to ensure compliance. This lag allows for the policy/strategy to be widely promoted to increase awareness among the providers. Therefore, since the year of policy/strategy enactment pre-dates the surveillance data, this is expected to have no or a minimal effect on the results. It is also assumed that testing rates would be the same in all states in the absence of state-specific policy/strategy approaches. This assumption is also a likely weakness because it is unlikely that all states would have similar rates if no testing policies or strategies were implemented.

Conclusion

This analysis provides evidence that the most important policy/strategy that states interested in increasing childhood blood lead testing should focus their limited resources on implementing is requiring proof of childhood blood lead testing for school enrollment as shown in Tables 4, 7, 11, and 14. Currently, only a limited number of states employ this approach so there is much potential for this policy to be implemented on a large scale so that increased testing rates can be achieved across the nation. States should also focus on two other important policies/strategies that were noted in this analysis: requiring reporting of HEDIS metrics for lead and providing MCO guidance, as shown in Tables 4, 6, 8, 9, 11, 13, and 15-16. To facilitate the adoption of additional childhood blood lead testing policies, states should work with their local AAP chapters, disseminate provider report cards that include data on lead testing performance, and raise awareness among decision-makers about the need to identify lead-exposed children so they can be connected to follow up services and interventions to mitigate the harmful effects of lead. Additionally, states should explore enacting policies that require private insurance companies to reimburse providers for conducting BLL testing for all at-risk children at 12–24 months of age would eliminate a major barrier surrounding access to health care.

States are encouraged to adopt additional policies and strategies to increase childhood blood lead testing since children with EBLLs who receive public health interventions are more likely to exhibit academic readiness, spend less time in special education, graduate high school, and have reduced contact with the criminal justice system which has social and economic benefits for society. After enough time has elapsed for states to adopt and implement additional childhood blood lead testing policies and strategies, a post-implementation evaluation can be done to evaluate the impact of the new policies/strategies on achieving increases in childhood blood lead testing.

More research into how the proportion of children who receive blood lead testing varies by socio-demographic characteristics of the children (e.g., race, ethnicity, income, urbanicity) would be helpful in further defining the problem and for developing targeted outreach and campaigns that address specific populations including providers and families. Knowing which sub-populations are more likely to have low proportions of children receiving blood lead tests will assist childhood lead poisoning prevention programs in addressing issues related to health equity and environmental justice. If the proportion of children who receive blood lead tests increases, further research should be done to describe how the population-level distribution and prevalence of BLLs has changed.

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APPENDICES

APPENDIX A

TABLES

Table 1A

Lead-Related Testing Strategies and Policies/Strategies and Proportion of Children Tested for Blood Lead Levels in 2017-2018, by State

State	**Metrics**	**Incentives**	**MCO Guidance**	**Provider Guidelines**	**Mandatory Reporting to State Health Department**	**Data Sharing Between Medicaid and Other State Agencies**	**Proof of Testing Required for School Enrollment**	**State Total**	**Proportion of Children Tested**
Alabama	0	0	0	1	1	0	0	2	0.11
Alaska	0	0	0	1	1	0	0	2	0.05
Arizona	0	0	0	1	0	0	0	1	0.15
Colorado	0	0	0	1	0	0	0	1	0.06
Connecticut	0	1	0	1	1	1	0	4	0.32
Delaware*	1	0	0	1	1	0	1	4	0.02
District of Columbia	1	0	0	1	0	0	0	2	0.32
Georgia	1	1	0	1	0	0	0	3	0.14
Hawaii	0	0	0	1	0	0	0	1	0.16
Illinois	0	1	0	1	1	0	1	4	0.19
Indiana*	1	1	1	1	1	0	0	5	0.12
Iowa	1	0	1	1	0	1	1	5	0.26
Louisiana*	1	0	1	1	1	0	0	4	0.15
Maine	0	1	0	1	0	0	0	2	0.17
Maryland	1	0	1	1	1	0	0	4	0.3
Massachusetts	1	0	1	1	1	0	0	4	0.48
Michigan*	1	1	0	1	0	0	0	3	0.22
Minnesota	0	1	0	1	0	0	0	2	0.22

Mississippi	0	0	0	1	1	1	0	3	0.17
Missouri	0	1	1	1	1	0	0	4	0.18
Nevada	1	0	0	0	1	0	0	2	0.04
New Hampshire	0	0	0	1	0	0	0	1	0.22
New Jersey	1	1	1	1	1	0	0	5	0.27
New Mexico	1	0	0	1	0	0	0	2	0.08
New York State	1	1	0	1	1	0	1	5	0.36
North Carolina	1	0	0	1	1	0	0	3	0.17
Ohio	0	0	0	1	0	0	0	1	0.2
Oklahoma	1	1	0	1	1	0	0	4	0.17
Oregon	0	0	0	1	1	0	0	2	0.06
Pennsylvania	0	0	1	1	0	1	0	3	0.17
Rhode Island	1	1	0	1	1	0	1	5	0.39
South Carolina	1	1	0	1	1	0	0	4	0.13
Tennessee	1	1	0	1	1	0	0	4	0.17
Texas*	0	0	1	1	1	0	0	3	0.13
Vermont	0	0	0	1	1	0	0	2	0.26
Washington	0	0	0	1	0	0	0	1	0.04
West Virginia	1	0	0	0	0	0	0	1	0.15
Wisconsin	1	0	1	0	1	1	0	4	0.23
Total	20	14	10	35	23	5	5		

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*% of children tested reported for 2017 only using publicly available data on states' websites; these states are only included in the sensitivity analyses.

Table 1B

Lead-Related Testing Strategies and Policies/Strategies in States Excluded from the Analyses, by State

State	**Metrics**	**Incentives**	**MCO Guidance**	**Provider Guidelines**	**Mandatory Reporting to State Health Department**	**Data Sharing Between Medicaid and Other State Agencies**	**Proof of Testing Required for School Enrollment**	**State Total**
Arkansas	0	0	0	1	0	0	0	1
California	1	0	1	1	0	0	0	3
Florida	1	0	1	0	0	0	0	2
Idaho	0	0	0	0	0	0	0	0
Kansas	0	0	0	1	0	0	0	1
Kentucky	1	0	0	1	0	0	0	2
Montana	0	0	0	1	0	0	0	1
Nebraska	1	0	0	1	1	0	0	3
North Dakota	0	0	0	1	0	0	0	1
South Dakota	0	0	0	0	0	0	0	0
Utah	0	0	0	1	0	0	0	1
Virginia	0	0	0	1	1	0	0	2
Wyoming	0	0	0	0	0	0	0	0
Total	4	0	2	9	2	0	0	

Table 2

*Distribution of Potential Risk Factors Obtained from 2017 U.S. Census Data, by Percent, for Each State Included in the Analyses**

State	**African American/ Black**	**Persons Ages ≥25 Years With at Least a High School Diploma**	**Pre-1980 Housing**	**Population <6 Years of Age with Medicaid Coverage**	**Foreign-Born**
Alabama	27.8	86.5	44.9	51.5	3.5
Alaska	4.7	91.7	40.0	42.7	7.9
Arizona	5.7	87.2	32.6	45.4	13.2
Colorado	5.3	91.6	44.9	37.9	9.8
Connecticut	12.4	90.4	70.9	36.5	14.8
Delaware*	23.8	90.6	44.4	39.9	10.2
District of Columbia	47.5	90.2	77.1	42.2	14.7
Georgia	33.1	87.0	35.2	45.1	10.2
Hawaii	3.7	92.3	53.3	35.7	18.6
Illinois	15.3	89.1	66.5	41.6	14.3
Indiana*	10.8	88.6	58.8	40.4	5.3
Iowa	4.6	92.1	65.4	38.3	5.3
Louisiana*	33.6	85.1	51.8	56.8	4.1
Maine	1.8	92.3	55.7	35.5	3.4
Maryland	31.8	89.9	54.8	35.9	15.3
Massachusetts	9.4	90.8	70.5	37.2	16.9
Michigan*	15.3	90.0	65.1	45.3	7.1
Minnesota	7.6	93.1	54.6	33.8	8.7
Mississippi	38.8	84.4	45.2	54.5	2.2
Missouri	12.7	89.7	56.2	39.2	4.2
Nevada	10.6	86.8	24.0	40.3	19.9
New Hampshire	2.3	93.1	53.6	34.3	6.2
New Jersey	14.8	89.9	66.5	34.9	22.8
New Mexico	3.0	86.1	45.9	62.2	9.4
New York	17.3	86.6	77.3	44.6	22.9
North Carolina	23	87.8	38.2	47.7	8.1
Ohio	14.2	90.3	67.1	42.6	4.5
Oklahoma	9.2	88.1	53.0	47.7	5.7
Oregon	3.0	91.0	52.7	46.8	9.9
Pennsylvania	12.7	90.6	69.3	41.0	7.0

Rhode Island	7.9	88.3	73.6	42.5	13.9
South Carolina	28.2	87.4	37.2	49.6	4.9
Tennessee	17.9	87.8	45.0	45.9	5.2
Texas*	13.1	83.6	38.9	45.3	17.1
Vermont	2.1	92.6	59.0	54.2	4.5
Washington	5.5	91.3	48.1	41.8	14.3
West Virginia	5.1	87.1	59.1	54.6	1.6
Wisconsin	7.5	92.4	60.3	35.8	5.0

*% of children tested reported for 2017 only using publicly available data on states' websites; these states are only included in the sensitivity analyses

Table 3

Correlation Coefficients and P-Values of Potential Risk Factors Obtained from 2017 U.S. Census Data for States Included in the Analyses

	African American/ Black	**Persons Ages ≥25 Years with at Least a High School Diploma**	**Pre-1980 Housing**	**Population <6 Years of Age with Medicaid Coverage**	**Foreign-Born**
African American/Black		-0.47 (p<0.01)	-0.04 (p=0.81)	0.23 (p=0.16)	-0.01 (0.96)
Persons ages ≥25 years with at least a high school diploma			0.35 (p=0.03)	-0.66 (p<0.01)	-0.04 (p=0.81)
Pre-1980 housing				-0.26 (p=.11)	0.13 (p=0.42)
Population <6 years of age with Medicaid coverage					-0.37 (p=0.02)

Table 4

Unadjusted Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017-2018

Policy/Strategy	**Regression Coefficient**	**95% Confidence Interval**	**P-Value**
Proof of testing required for school enrollment	0.12	0.01, 0.23	0.03
Other MCO guidance	0.10	0.01, 0.18	0.03
Metrics	0.07	0.00, 0.21	0.06
Provider guidelines	0.06	-0.07, 0.19	0.34
Incentives	0.05	0.00, 0.13	0.18
Data sharing between Medicaid and other state agencies	0.04	-0.06, 0.15	0.40
Mandatory reporting to state health departments	0.03	-0.03, 0.12	0.22
Total number of policies	0.04	0.02, 0.07	<0.01

Table 5

Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017-2018, Individually Adjusted by One Potential Risk Factor

Potential Risk Factor	**Regression Coefficient**	**95% Confidence Interval**	**P-Value**
Proof of testing required for school enrollment			
Unadjusted	0.12	0.01, 0.23	0.03
African American/Black	0.13	0.02, 0.23	0.02
Persons ages ≥25 years with at least a high school diploma	0.13	0.02, 0.23	0.02
Pre-1980 housing	0.02	-0.07, 0.10	0.68
Population <6 years of age with Medicaid coverage	0.11	0.01, 0.22	0.03
Foreign-born	0.10	-0.01, 0.21	0.07
Other MCO guidance			
Unadjusted	0.10	0.01, 0.18	0.03
African American/Black	0.10	0.01, 0.18	0.03
Persons ages ≥25 years with at least a high school diploma	0.10	0.00, 0.19	0.04
Pre-1980 housing	0.04	-0.03, 0.10	0.25
Population <6 years of age with Medicaid coverage	0.08	-0.02, 0.17	0.10
Foreign-born	0.09	0.01, 0.17	0.03
Metrics			
Unadjusted	0.07	0.00, 0.21	0.06
African American/Black	0.06	-0.01, 0.14	0.09
Persons ages ≥25 years with at least a high school diploma	0.09	0.02, 0.17	0.02
Pre-1980 housing	0.06	0.02, 0.11	0.01
Population <6 years of age with Medicaid coverage	0.08	0.01, 0.15	0.03
Foreign-born	0.05	-0.02, 0.13	0.12
Provider guidelines			
Unadjusted	0.06	-0.07, 0.19	0.34
African American/Black	0.05	-0.08, 0.18	0.42
Persons ages ≥25 years with at least a high school diploma	0.06	-0.07, 0.19	0.38
Pre-1980 housing	0.02	-0.07, 0.11	0.66
Population <6 years of age with Medicaid coverage	0.06	-0.07, 0.18	0.35
Foreign-born	0.05	-0.07, 0.18	0.38

Incentives			
Unadjusted	0.05	0.00, 0.13	0.18
African American/Black	0.05	-0.03, 0.13	0.21
Persons ages ≥25 years with at least a high school diploma	0.06	-0.02, 0.13	0.14
Pre-1980 housing	0.02	-0.03, 0.08	0.38
Population <6 years of age with Medicaid coverage	0.04	-0.03, 0.12	0.28
Foreign-born	0.04	-0.03, 0.12	0.24
Data sharing between Medicaid and other state agencies			
Unadjusted	0.04	-0.06, 0.15	0.40
African American/Black	0.04	-0.06, 0.14	0.43
Persons ages ≥25 years with at least a high school diploma	0.04	-0.06, 0.15	0.43
Pre-1980 housing	-0.01	-0.08, 0.06	0.79
Population <6 years of age with Medicaid coverage	0.03	-0.07, 0.14	0.49
Foreign-born	0.07	-0.03, 0.17	0.18
Mandatory reporting to state health departments			
Unadjusted	0.03	-0.03, 0.12	0.22
African American/Black	0.04	-0.04, 0.12	0.29
Persons ages ≥25 years with at least a high school diploma	0.06	-0.02, 0.13	0.14
Pre-1980 housing	0.04	0.00, 0.09	0.07
Population <6 years of age with Medicaid coverage	0.05	-0.02, 0.12	0.14
Foreign-born	0.04	-0.03, 0.11	0.30
Total number of policies			
Unadjusted	0.04	0.02, 0.07	<0.01
African American/Black	0.04	0.02, 0.07	<0.01
Persons ages ≥25 years with at least a high school diploma	0.05	0.02, 0.07	<0.01
Pre-1980 housing	0.02	0.01, 0.04	<0.01
Population <6 years of age with Medicaid coverage	0.04	0.02, 0.06	<0.01
Foreign-born	0.04	0.02, 0.06	<0.01

Table 6

Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017-2018, Adjusted for Age of Housing, Population <6 Years of Age with Medicaid Coverage, and Foreign-Born

Policy/Strategy	**Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Proof of testing required for school enrollment	0.01	-0.08, 0.10	0.84
Other MCO guidance	0.04	-0.03, 0.11	0.28
Metrics	0.06	0.01, 0.11	0.01
Provider guidelines	0.02	-0.07, 0.11	0.69
Incentives	0.02	-0.03, 0.07	0.47
Data sharing between Medicaid and other state agencies	0.00	-0.07, 0.08	0.93
Mandatory reporting to state health departments	0.04	-0.01, 0.09	0.08
Total number of policies	0.02	0.00, 0.04	0.33

Table 7

Unadjusted and Adjusted Results of Associations Between Proof of Testing Required for School Enrollment Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017-2018

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Proof of testing required for school enrollment and metrics	0.16	0.04, 0.28	<0.01	0.05	-0.05, 0.15	0.30
Proof of testing required for school enrollment and incentives	0.13	0.01, 0.25	0.03	0.00	-0.10, 0.11	0.95
Proof of testing required for school enrollment and MCO guidance	0.07	-0.15, 0.29	0.53	0.02	-0.14, 0.17	0.81
Proof of testing required for school enrollment and provider guidelines	0.12	0.01, 0.23	0.03	0.01	-0.08, 0.10	0.85
Proof of testing required for school enrollment and mandatory reporting to state health departments	0.13	0.01, 0.25	0.03	0.00	-0.10, 0.11	0.95
Proof of testing required for school						

enrollment and data sharing between Medicaid and other state agencies	0.07	-0.15, 0.29	0.53	0.02	-0.14, 0.17	0.81

Table 8

Unadjusted and Adjusted Results of Associations Between MCO Guidance Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017-2018

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
MCO guidance and metrics	0.13	0.04, 0.23	0.01	0.08	0.00, 0.15	0.04
MCO guidance and incentives	0.04	-0.12, 0.19	0.63	-0.02	-0.13, 0.09	0.73
MCO guidance and provider guidelines	0.10	0.01, 0.19	0.03	0.04	-0.03, 0.11	0.30
MCO guidance and mandatory reporting to state health departments	0.12	0.02, 0.21	0.02	0.07	0.00, 0.14	0.07
MCO guidance and data sharing between Medicaid and other state agencies	0.06	-0.10, 0.15	0.66	-0.03	-0.13, 0.07	0.51

Table 9

Unadjusted and Adjusted Results of Associations Between Metrics and Other State Agencies Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017-2018

Policy/Strategy	**Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Metrics and incentives	0.05	-0.04, 0.14	0.26	0.04	-0.02, 0.10	0.53
Metrics and provider guidelines	0.09	0.02, 0.16	0.01	0.08	0.03, 0.12	<0.01
Metrics and mandatory reporting to state health departments	0.08	0.00, 0.15	0.04	0.07	0.02, 0.12	<0.01
Metrics and data sharing between Medicaid and other state agencies	0.05	-0.10, 0.21	0.50	0.02	-0.10, 0.13	0.77

Table 10

Results of Unadjusted and Adjusted Associations Between Mandatory Reporting of Childhood Blood Testing Results Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017-2018

Policy/Strategy	**Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression coefficient**	**95% Confidence Intervals**	**P-Value**
Mandatory reporting to state health departments and incentives	0.07	-0.01, 0.15	0.10	0.01	-0.05, 0.08	0.63
Mandatory reporting to state health departments and provider guidelines	0.06	-0.01, 0.13	0.10	0.05	0.00, 0.10	0.07
Mandatory reporting to state health departments and data sharing between Medicaid and other state agencies	0.05	-0.08, 0.18	0.42	0.03	-0.05, 0.12	0.43

Sensitivity Analyses

Table 11

Unadjusted Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017

Policy/Strategy	**Regression Coefficient**	**95% Confidence Interval**	**P-Value**
Proof of testing required for school enrollment	0.07	-0.03, 0.17	0.19
Other MCO guidance	0.06	-0.02, 0.14	0.12
Metrics	0.05	0.11, 0.21	0.13
Provider guidelines	0.05	-0.08, 0.18	0.42
Incentives	0.05	-0.02, 0.13	0.12
Data sharing between Medicaid and other state agencies	0.05	-0.05, 0.16	0.29
Mandatory reporting to state health departments	0.03	-0.04, 0.10	0.45
Total number of policies	0.03	0.01, 0.05	0.01

Table 12

Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017, Individually Adjusted by One Potential Risk Factor

Potential Risk Factor	**Regression Coefficient**	**95% Confidence Interval**	**P-Value**
Proof of testing required for school enrollment			
Unadjusted	0.07	-0.03, 0.17	0.19
African American/Black	0.07	-0.03, 0.17	0.18
Persons ages ≥25 years with at least a high school diploma	0.07	-0.03, 0.17	0.18
Pre-1980 housing	-0.01	-0.09, 0.06	0.73
Population <6 years of age with Medicaid coverage	0.06	-0.04, 0.16	0.24
Foreign-born	0.05	-0.05, 0.15	0.33
Other MCO guidance			
Unadjusted	0.06	-0.02, 0.14	0.12
African American/Black	0.06	-0.02, 0.14	0.13
Persons ages ≥25 years with at least a high school diploma	0.06	-0.02, 0.14	0.04
Pre-1980 housing	0.02	-0.04, 0.07	0.49
Population <6 years of age with Medicaid coverage	0.05	-0.03, 0.13	0.23
Foreign-born	0.06	-0.02, 0.13	0.14
Metrics			
Unadjusted	0.05	0.11, 0.21	0.13
African American/Black	0.05	-0.02, 0.12	0.18
Persons ages ≥25 years with at least a high school diploma	0.07	0.00, 0.14	0.06
Pre-1980 housing	0.04	-0.01, 0.08	0.09
Population <6 years of age with Medicaid coverage	0.06	0.0, 0.13	0.07
Foreign-born	0.05	-0.02, 0.11	0.17
Provider guidelines			
Unadjusted	0.05	-0.08, 0.18	0.42
African American/Black	0.05	-0.09, 0.18	0.49
Persons ages ≥25 years with at least a high school diploma	0.05	-0.08, 0.18	0.46
Pre-1980 housing	0.01	-0.08, 0.10	0.81
Population <6 years of age with Medicaid coverage	0.05	-0.08, 0.18	0.42
Foreign-born	0.05	-0.08, 0.17	0.46

Incentives			
Unadjusted	0.05	-0.02, 0.13	0.12
African American/Black	0.05	-0.02, 0.13	0.13
Persons ages ≥25 years with at least a high school diploma	0.06	-0.01, 0.13	0.11
Pre-1980 housing	0.02	-0.03, 0.07	0.66
Population <6 years of age with Medicaid coverage	0.05	-0.03, 0.12	0.20
Foreign-born	0.05	-0.02, 0.12	0.14
Data sharing between Medicaid and other state agencies			
Unadjusted	0.05	-0.05, 0.16	0.29
African American/Black	0.05	-0.05, 0.16	0.30
Persons ages ≥25 years with at least a high school diploma	0.05	-0.05, 0.15	0.33
Pre-1980 housing	0.00	-0.07, 0.07	0.95
Population <6 years of age with Medicaid coverage	0.05	-0.06, 0.15	0.37
Foreign-born	0.07	-0.03, 0.18	0.14
Mandatory reporting to state health departments			
Unadjusted	0.03	0.01, 0.05	0.01
African American/Black	0.02	-0.05, 0.10	0.54
Persons ages ≥25 years with at least a high school diploma	0.04	-0.03, 0.12	0.27
Pre-1980 housing	0.04	-0.01, 0.08	0.12
Population <6 years of age with Medicaid coverage	0.03	-0.04, 0.10	0.34
Foreign-born	0.02	-0.05, 0.09	0.57
Total number of policies			
Unadjusted	0.03	-0.04, 0.10	0.45
African American/Black	0.03	0.01, 0.06	0.01
Persons ages ≥25 years with at least a high school diploma	0.04	0.01, 0.06	<0.01
Pre-1980 housing	0.02	0.00, 0.03	0.09
Population <6 years of age with Medicaid coverage	0.03	0.01, 0.06	0.01
Foreign-born	0.03	0.00, 0.06	0.01

Table 13

Results of Associations Between Blood Lead Testing Policies/Strategies and the Proportion of Children Tested for Blood Lead Levels in 2017, Adjusted for Age of Housing, Population <6 Years of Age with Medicaid Coverage, and Foreign-Born

Policy/Strategy	**Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Proof of testing required for school enrollment	-0.03	-0.10, 0.05	0.48
Other MCO guidance	0.02	-0.04, 0.07	0.50
Metrics	0.04	-0.01, 0.08	0.11
Provider guidelines	0.01	-0.08, 0.10	0.85
Incentives	0.02	-0.04, 0.07	0.54
Data sharing between Medicaid and other state agencies	0.01	-0.06, 0.09	0.73
Mandatory reporting to state health departments	0.03	-0.01, 0.08	0.17
Total number of policies	0.01	0.00, 0.03	0.01

Table 14

Unadjusted and Adjusted Results of Associations Between Proof of Testing Required for School Enrollment Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Proof of testing required for school enrollment and metrics	0.09	-0.02, 0.20	0.12	0.00	-0.08, 0.08	0.16
Proof of testing required for school enrollment and incentives	0.14	0.02, 0.26	0.03	-0.01	-0.11, 0.10	0.90
Proof of testing required for school enrollment and MCO guidance	0.07	-0.14, 0.29	0.49	0.02	-0.13, 0.18	0.75
Proof of testing required for school enrollment and provider guidelines	0.07	-0.03, 0.17	0.19	-0.03	-0.10, 0.05	0.48
Proof of testing required for school enrollment and mandatory reporting to state health departments	0.06	-0.05, 0.17	0.27	-0.04	-0.12, 0.04	0.33
Proof of testing required for school enrollment and data sharing between Medicaid and other state agencies	0.07	-0.14, 0.29	0.49	0.02	-0.13, 0.18	0.75

Table 15

Unadjusted and Adjusted Results of Associations Between MCO Guidance Combined with Another Policy and the Proportion of Children Tested for Blood Lead Levels in 2017

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
MCO guidance and metrics	0.09	0.00, 0.17	0.04	0.04	-0.02, 0.10	0.21
MCO guidance and incentives	0.01	-0.12, 0.14	0.89	-0.04	-0.12, 0.05	0.40
MCO guidance and provider guidelines	0.06	-0.02, 0.14	0.14	0.02	-0.04, 0.07	0.54
MCO guidance and mandatory reporting to state health departments	0.06	-0.02, 0.15	0.15	0.03	-0.02, 0.09	0.25
MCO guidance and data sharing between Medicaid and other state agencies	0.03	-0.10, 0.16	0.52	-0.03	-0.12, 0.07	0.05

Table 16

Unadjusted and Adjusted Results of Associations Between Metrics Combined with Another Policy and Proportion of Children Tested for Blood Lead Levels in 2017

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**
Metrics and incentives	0.05	-0.03, 0.13	0.24	0.03	-0.03, 0.09	0.27
Metrics and provider guidelines	0.07	00.00, 0.13	0.05	0.07	0.02, 0.11	0.01
Metrics and mandatory reporting to state health departments	0.05	-0.02, 0.12	0.19	0.07	0.02, 0.12	0.01
Metrics and data sharing between Medicaid and other state agencies	0.06	-0.10, 0.21	0.46	0.02	-0.10, 0.13	0.74

Table 17

Unadjusted and Adjusted Results of Associations Between Mandatory Reporting of Childhood Blood Lead Testing Results to the State Health Department Combined with Another Policy and Proportion of Children Tested for Blood Lead Levels in 2017

Policy/Strategy	**Unadjusted Regression Coefficient**	**95% Confidence Intervals**	**P-Value**	**Adjusted Regression Coefficient**	**95% Confidence Intervals**	**P-value**
Mandatory reporting to state health departments and incentives	0.06	-0.01, 0.14	0.10	0.02	-0.04, 0.07	0.59
Mandatory reporting to state health departments and provider guidelines	0.04	-0.03, 0.10	0.28	0.05	0.00, 0.09	0.05
mandatory reporting to state health departments and data sharing between Medicaid and other state agencies	0.07	-0.06, 0.19	0.30	0.04	-0.05, 0.12	0.40

APPENDIX B

FIGURES

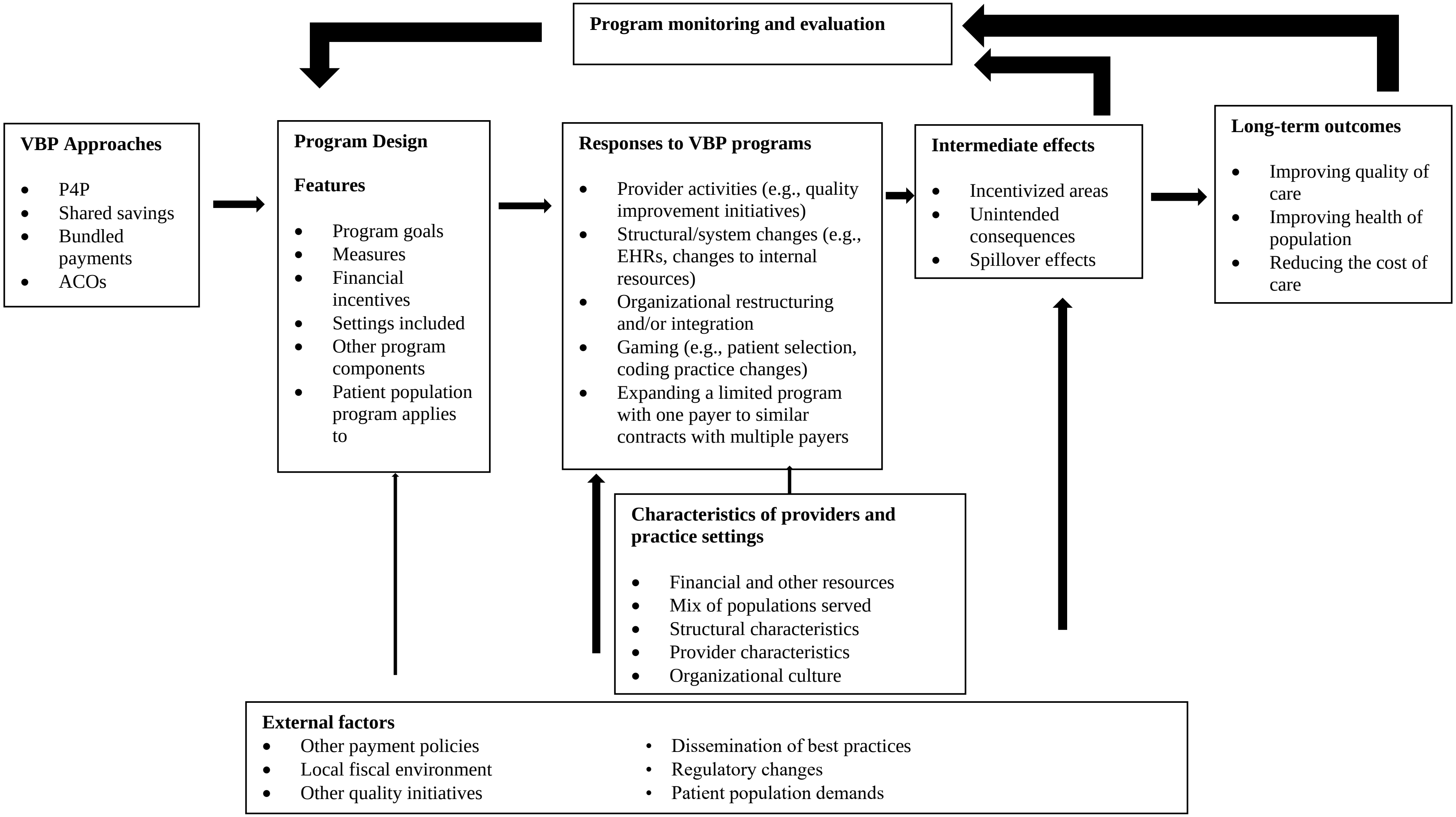

Figure 1. Value-based purchasing conceptual framework. Adapted from “Measuring Success in Health Care Value-Based Purchasing Programs: Findings from an Environmental Scan, Literature Review, and Expert Panel Discussions.,” by C.L. Damberg, M.E. Sorbero, S.L. Lovejoy, G.R. Martsolf, L. Raaen, & D. Mandel, 2014, *Rand Health Quarterly*, *4*(3), 9, page 45. Copyright 2014 by the Rand Corporation. Adapted with permission.

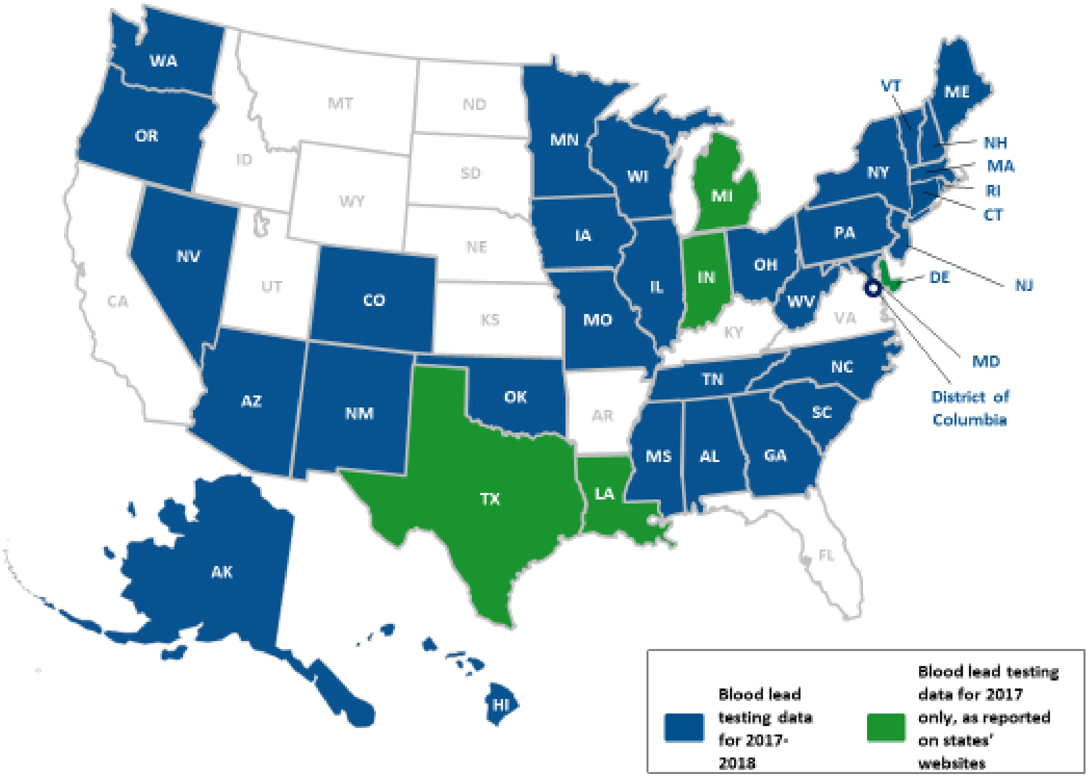

Figure 2. States included in the analysis of the association between childhood blood lead testing rates and blood lead testing policies and strategies.

APPENDIX C

QUESTIONS FOR STATES ABOUT BLOOD LEAD TESTING POLICIES/STRATEGIES

In 2018, the National Academy for State Health Policy (NASHP) and the Maternal Child Environmental Health Collaborative Improvement Innovation Network (MCEH COIIN) published a document that summarized, by state, all childhood lead-related policies that promote lead screening and treatment. The document categorizes the policies into six strategies and approaches: lead screening metrics, lead screening incentives, other Managed Care Organization (MCO) guidance, Medicaid/Children's Health Insurance Program (CHIP) eligibility, provider guidelines in addition to federal Medicaid requirements, and/or other requirements (e.g., lead registry, reporting requirements, screening requirements for school enrollment).

I would like to gain a better understanding of reasons why states with a low number (1) of testing strategies have not implemented approaches and conversely what are the reasons why some states did implement a high number (5-6) of strategies to increase testing.

Questions for states with a low number of testing strategies

The Centers for Medicare & Medicaid Services require blood lead tests for all children with Medicaid coverage at ages 12 months and 24 months or between ages 24 and 72 months if the child has no record of a previous blood lead test. Although there are many approaches available to promote lead screening, your state has only been categorized as using only one or two approaches.

According to the report, your state has # of strategies to promote childhood blood lead testing. These include____________________________.

1. Are you aware of any efforts to add additional blood lead testing strategies in your state?

   Yes
   No

2. If yes, please describe the efforts

3. If no, what are the reasons your state has not pursued additional approaches?

   a. Not aware of additional options
   b. Lack of resources
   c. Lack of interest from decision makers
   d. Other (please describe)

<u>Questions for states with a high number of testing strategies</u>

The Centers for Medicare & Medicaid Services require blood lead tests for all children with Medicaid coverage at ages 12 months and 24 months or between ages 24 and 72 months if the child has no record of a previous blood lead test. There are many approaches available to promote lead screening, and according to the report, your state has # of strategies to promote childhood blood lead testing. These include_____________________________.

1. What are the reasons your state has pursued having a comprehensive set of strategies to promote childhood blood lead testing?
2. Are you aware of any efforts to add additional blood lead testing strategies in your state?

   Yes

   No

3. If yes, please describe the efforts.